

CIET |
2022

16-17 June
VALENCIA

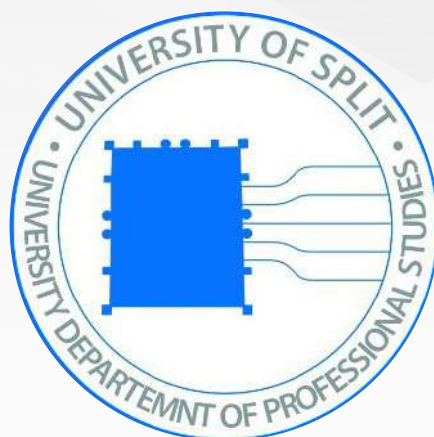
Contemporary issues in
economy & technology

**CONFERENCE
PROCEEDINGS**

ORGANIZER



Florida Universitària in Valencia, Spain



University of Split, Department of Professional Studies
Split, Croatia



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Dear participants and dear colleges,

The University Department of Professional Studies of the University of Split has continually, for years, maintained the international conference Contemporary Issues in Economy & Technology – CIET. CIET conference is celebrating 5th anniversary, the first 4 conferences were held in Split at our University Department of Professional Studies in Split. Since 2014, we put in a lot of effort to reach a respectable international level, what is confirmed by this 5th international scientific and professional conference. The 5th international scientific and professional conference entitled Contemporary Issues in Economy & Technology – CIET 2022 was organized in collaboration with Florida Universitària in Valencia, Spain to whom I want to thank for contribution in the organization of the conference.

Through the 5th international scientific and professional conference CIET 2022 we wish to share knowledges and ideas in Economy & Technology. Sharing what we do and how we do it, collaborating with other professors, researchers, representatives from industry and students, we develop a scientific and professional network, we increase our awareness of news and trends in our fields and consolidate our business and personal cooperation.

It has been a pleasure for us to collaborate with Florida Universitària and participate, in Valencia, on the 5th edition of international conference, CIET 2022.

With great pleasure University Department of Professional Studies of the University of Split announcing the 6th international conference " Contemporary Issues in Economy & Technology – CIET " which will take place 2024 in Split, Croatia.

We are looking forward to meeting you all in Split at CIET 2024.

Head of the University Department of Professional Studies

Petar Pepur, PhD, college professor

Society in the 21st century faces many uncertainties that result in an urgent need for the ability to deal with all kinds of complex situations. On the other hand, technology and science have a fundamental role to play at this time. In the first case, there is no doubt about the vertiginous progress we are experiencing in terms of technological development in all areas of our society, which is constantly growing thanks to research and innovation. In the second case, the recent experience of the Covid-19 pandemic at world level has been a superlative challenge that we have been able to overcome thanks to advances in scientific research. Research therefore appears to be a backbone of our societies that cannot be neglected under any circumstances, and which universities must always develop with the aim of transferring their knowledge for the benefit of society.

On the other hand, climate change and the risk of resource scarcity also force us to add an essential element to our research work, namely sustainability, always bearing in mind the objective imposed by the European Commission in the 2030 Agenda. However, we must not stop at environmental sustainability, which is very important and absolutely necessary if we want to leave our children a planet worthy of living on. In addition, we must look for the triple bottom line to achieve sustainability at the economic and social level as well. Without these three axes united, society will not be able to function properly and it is for this reason that research is a fundamental pillar that analyses, based on innovation and ethical values, how to contribute value to make our society much better.

However, we must also remember at all times that this transfer of knowledge in universities must also be passed on to students because they are the future. Therefore, the early development of the research spirit in them, providing the aforementioned ethical value, is essential if the world is to be a better place. In the same way, researchers must share their knowledge with their counterparts in other universities and organisations in order to join forces that can always help to improve in all areas of life. In this sense, the organisation of international academic-scientific conferences such as this 5th edition of CIET is the perfect scenario for achieving synergies and even joint projects for the future that are so beneficial for all parties involved as well as for the final beneficiaries of these research projects.

In short, development comes through research and innovation, and these are rooted in universities and research centres. Creating opportunities for experts to meet and exchange their experiences and research is an absolute necessity and it is our obligation to put in place the actions to implement them. Not without forgetting the enormous importance of bringing together experts from different countries with different cultures and different ways of dealing with life and social expectations. This is undoubtedly the best way to bring people, knowledge and sensitivities together and thus to advocate for a peaceful world, which is unfortunately so precarious at the moment worldwide.

Dr. Mercedes Aznar

President of CIET Scientific and Organising Committees

President of Florida Cooperative Education Group

Editorial Welcome

Dear colleagues it is our great pleasure to welcome you to the electronic edition of scientific and professional proceedings published from the 5th biennial international conference entitled CONTEMPORARY ISSUES IN ECONOMY & TECHNOLOGY - CIET 2022 - which was held on 16th and 17th June, 2022 in Valencia, Spain.

The University Department of Professional Studies, University of Split, Croatia, together with the conference co-organizer Florida Universitària in Valencia, Spain and partners from George Bacovia University, Bacău, Romania, University of Valencia, Spain, Polytechnic University of Valencia, Spain, Trade Co-operative University of Moldova, Chisinau, Moldova and Polytechnic of Guarda, Guarda, Portugal, had a great privilege to have hosted such a prestigious event.

The 5th Conference Contemporary Issues in Economics and Technology – CIET 2022 was held from in a hybrid format, both for attendees and for researchers who wanted to present a paper.

Contemporary Issues in Economy and Technology (CIET) is an international scientific and professional conference organized by the University Department of Professional Studies, University of Split. It was launched in 2014 and it has been held biannually in Split, Croatia. This is the first time that CIET “made a trip” to beautiful city of Valencia.

The conference proceedings contain three different categories of papers: scientific, professional and junior researchers’ papers. CIET from its first edition emphasises importance of closer connections between science and the professional world, which has been confirmed in this year addition. Added value of this year addition is provided space for presentation of our junior researchers which gave them great possibility to present their findings to wider audience.

The themes of this conference focus on contemporary issues that draw the attention of both scientists and professionals from all over Europe who travelled to Valencia to exchange experiences and work together in the areas of finance and economics, entrepreneurship, tourism and international trade, electrical engineering, information technology, mechanical engineering, videogames and interdisciplinary approaches to teaching and learning.

Furthermore, a double-blind reviewed selection of presented scientific (53), professional (26) and junior research papers (3) from the above mentioned fields can be found in this electronic edition with assigned the ISBN number prepared by the Split University Library. On behalf of all the members of the organising committee, we look forward to welcoming you to the pages of this electronic edition.

Editors-in-chief

Domagoja Buljan Barbača, PhD, tenured college professor

Marko Miletić, PhD, college professor



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Track 1

**Accounting
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SCIENTIFIC PAPERS

FAIR VALUE IN THE CONTEXT OF ACCOUNTING QUALITY

Lina Paliulienė

Kaunas University of Applied Sciences, Kaunas, Lithuania
lina.paliuliene@go.kauko.lt

Indrė Knyvienė

Kaunas University of Applied Sciences, Kaunas, Lithuania
indre.knyvien@go.kauko.lt

Abstract. The purpose of this article to analyse evaluation of financial statements' elements at fair value, an impact of the fair value on qualitative characteristics of accounting information: understandability, relevance, reliability and comparability. The fair value provides more understandable, relevant, reliable and comparable accounting information than a historical cost. However, this method of evaluation receives a lot of criticism. When there is no active market, accounting information's understandability, relevance, reliability and comparability, evaluating according to the fair value, is disputed. In particular, the reliability of accounting information is questioned. However, despite the criticism, an application of the fair value's method is the only possibility correctly to identify a value of financial statements' clauses, which is particularly relevant to users of accounting information when making optimal economic decisions.

Key words: *fair value, accounting information, qualitative characteristics.*

1. Introduction

Objective and reliable accounting information about the financial condition of the company helps accounting information's users to make right economic decisions. Shareholders are interested to get correct information of financial statements, because it is important for them to know what to expect from possessing investments. According to company's financial statements and company's prospects shareholders decide on shares purchase/sale. It is also important for creditors to get objective information about company's assets, since they want to ensure that the company which received a loan or goods on credit will be able to cover the indebtedness in time.

In scientific literature many researchers deal with these problems: how the fair value is calculated (Hitz, 2007; Shamkuts, 2010; Enahoro & Jayeoba, 2013); what is the impact of the fair value on the financial crisis (Laux & Leuz, 2010; Fen, Chen & Fu, 2010) and on the company's stewardship (Barlev & Haddad, 2003; Christensen & Nikolaev, 2009; Ronen, 2008). However, researchers have not adequately address the effects of the fair value to accounting information which is necessary for accounting information's users in making economic decisions.

The object of the research – the fair value's method.

The aim of the research – theoretically to base the impact of the fair value on qualitative characteristics of accounting information.

Methods of the research: analysis of scientific literature, comparison, generalization.

2. Evaluation at the fair value

The main purpose of financial statements is to provide for various users useful and necessary information for making economic decisions. Correctly collected and summarized information is the main source for optimal and correct decisions. The needs of information's users are very different. For example, shareholders are most interested in information about risk and profitability of their investments. Creditors are interested in the company's financial condition and its possibilities to pay for the goods / to return a loan at the agreed time. Usefulness of accounting information in making economic decisions is an important criterion when choosing a method of evaluation of financial statements' elements. Financial statements' elements can be assessed by various methods, based on the cost and the fair value. Damant (2001) and Scott (2002) argued that the fair value emerged as a result of fulfilment of users' needs. In IFRS 13 "Fair value measurement" the **fair value** is defined as a sum for which an asset could be exchanged between unrelated parties, intended to buy (sell) or to cover mutual liabilities. The fair value is an evaluation based on market forces. The fair value provides information that reflects company's financial condition and stewardship, indicating assets and liabilities in the balance sheet in the current market (Penman, 2007). A balance is the key tool for providing information to shareholders. The balance in the fair value's method may be as a basis to calculate future values of assets and liabilities. An income statement can not be the basis for predicting future values because of changes of profit and expenses that occur due to reappraisal of an asset and liabilities. The balance in the fair value's method provides effective values and the income statement conveys information about stewardship process and risk. Penman (2007) noted that the income statement prepared using the fair value's method may be a tool of investment management. The income statement may reflect investment success and risk in which investors are interested. Song, Wang Wheeler (2021) noted that including fair value changes in net income makes net income unnecessarily volatile, proponents counter that additional volatility resulting from measuring assets and liabilities at fair value may be informative about economic risk.

Bonaci and Strouhal (2007) maintained that the fair value's method is more perspective as it allows to set more realistic asset's value and true and correct financial condition of the company. According to researchers, in the balance sheet provided asset valued at the fair value corresponds to the actual value of the asset at the date of forming financial statements, as well as asset's valuation at the fair value corresponds to accounting principle of precaution and has valuable feedback information to the users of accounting information.

The fair value reflects current conditions of the market, therefore it provides timely information about processes in the market, enhances the clarity and transparency of the market. Shen (2022) pointed that the level of enterprise fair value measurement has a significant positive impact on the increase in net profit, the improvement in the ability of debt financing, the increase in total assets, the increase in the level of executive compensation and the increase in enterprise value. Wang (2010) claims that evaluation of the asset at the fair value is very important for creditors' and investors' decisions, because this evaluation method reflects company's true financial condition. The historical cost method also affects economic decision-making as long

as accounting value reasonably corresponds to the fair value. When the historical cost deviates from the fair value, the impact on economic decision-making based on a historical cost decreases. The world must gradually abandon the historical cost method and need to apply the fair value's method.

After analysing literature, it was noticed that many researchers offer the fair value's method to be used for companies that have a lot of long-dated asset with a long term of use and which value changes frequently in the market. In their view, if the asset is priced at the fair value, it is possible to get more accurate evaluation of financial indicators: company's liquidity, profitability of the asset and so on.

The research author claims that it is appropriate for companies to use the fair value's method. Although this method is more complicated and requires more work expenses, however using it company's financial condition is reflected more precisely, which is very important for external users of accounting information, as true and fair information about financial condition of the company helps to make right economic decisions.

3. The impact of the fair value on the quality of accounting information

A value of accounting information for users is determined by its qualitative characteristics. In economic literature and legislation a different amount of accounting information's qualitative characteristics is and its names is provided. In the Accounting Law of the Republic of Lithuania it is indicated that the company must keep records so that accounting information would be: 1) proper, objective and comparable; 2) timely; 3) sufficiently comprehensive and valuable for internal and external users (AL, 2001, p. 6). Stoner, Freeman, & Gilbert (1999) states that "information must correspond to four criteria: 1) quality, 2) timeliness, 3) amount, 4) suitability for management" (p. 603 - 604). In "Financial statements' preparation and presentation system" prepared by International Accounting Standards Committee's it is indicated that the main qualitative characteristics of accounting information are as follows: **1) understandability, 2) relevance, 3) reliability, 4) comparability** (IAS, 2002, p. 13).

Understandability is a prerequisite because misunderstood information can not be useful. Understandability means that financial statements must be easily understandable for users of information. The fair value improves understandability of financial accountability, because as the basis of evaluation a market value is used. However, it should be mentioned that understanding of the fair value requires specific knowledge and ordinary users of financial accountability may not have it. If the asset is unique, often it is difficult to determine its fair value, which means that as well it is difficult for users of financial accountability's information to understand the fair value of such asset (Wang, 2012).

Relevance and reliability are the most important qualitative characteristics of accounting information. A feature of **relevance** of financial statements means that information is relevant if it affects decision-making of information's users and helps to evaluate past, current or future events. Relevance of information is affected by its significance. Information is significant if failure to submit it or its improper submission affects economic decisions of information's users (Mackevicius, 2004). Barth, Beaver and Landsman (2001) argued that relevance is generally associated with reliability. Qualitative characteristics of accounting's relevance and reliability were begun to explore in early 1900s. These studies were called *value relevance research*, where

accounting data has been defined as the actual value if it has predictable connection with a value of stock market. Researchers sought to determine whether financial accountability data is related to the value of securities (Gaffikin, 2007).

Christensen and Nikolaev (2009) maintained that the most contentious issue, when choosing the fair value's or the historical cost's method, is their relevance and reliability. Setters of accounting standards recommend for companies to use the fair value's method, because the fair value provides more recent and relevant information to investors and creditors than the historical cost. The fair value is more useful for users when assessing company's activities and forecasting company's cash flow and financial condition (Christensen & Nikolaev, 2009). Emerson, Karim and Rutledge (2010) maintained that the fair value's method has greater relevance, because this method precisely reflects the market value in current economic conditions, which is directly beneficial for users of accounting information for decision making. Over time, the historical cost is becoming irrelevant when assessing company's financial condition. The fair value's method provides timely information about the value of company's asset (Penman, 2007).

Nevertheless, even if the market value does not reflect the fair value, it is not worth for the company to choose the historical cost method. The historical cost is characterized by the lack of relevant accounting information and it gives the past rather than present financial information, so it is better to use the fair value, even if the market is illiquid (Laux & Leuz, 2009).

Many researchers often link relevance with timeliness. The fair value reflects the current market conditions, therefore it provides timely information about processes in the market, enhances clarity and transparency of the market (Penman, 2007). The fair value is timely because it reflects an impact of economics on the company within a certain period of time (Emerson et al., 2010). Barlev and Haddad (2003) indicated that the use of the fair value provides timely and relevant information that can lead to changes in management's philosophy and strategy. They maintained that the fair value increases shareholders' opportunity to monitor the value of their capital and efficiency of management, what makes managers to conduct in a way to increase the value of stocks. As well as the fair value provides the latest information in financial statements, what makes it easier to assess stocks and at the same time to reduce risk of management by providing factual information about company's financial condition.

However, there are many who have doubts in relevance of the fair value. Fen et al. (2010) determined that features of industry, changes of financial and economic conditions affect the fair value's provided information and its relevance decreases, especially during the financial crisis (such as the global financial crisis in 2008.). Khurana and Kim (2003) believe that the fair value is less relevant than the historical cost, when there is no active market.

Many bankers criticize decreased relevance of the fair value when market prices rapidly decline and / or when the market is illiquid. In their opinion, FASB order to use the fair value contributed to the financial crisis (King, 2009). Flegm (2005) believes that the fair value's method is considered to be subjective, because it can cause manipulations of management with financial statements and an abuse when evaluating the asset.

Benston (2008) maintained that the fair value is potentially misleading, because fluctuations of asset's value are significant in the long term. In addition, prices may be distorted due to market's inefficiency, irrationality of investors or liquidity problems. Asset's valuation by the fair value looks more like a forecast, not a reality. Flegm (2005) argued that it is necessary to reduce subjectivity of the fair value. Scott (2005) indicated that setters of standards should focus more on the fair value's rules and to provide more details which would control the process of evaluation by the fair value which would help to reveal more relevant and reliable information.

A feature of **reliability** Toluwa, Otakefe (2019) maintained the concept of reliability, is one of the qualitative characteristics of financial statement which is defined as the quality of information that assures that financial statement information is reasonably devoid of errors and biases of financial statements maintains that information is reliable when it is free from material errors and provides what it is supposed to provide or what users expect. Barlev and Haddad (2003) suggest that reliability means that the company provides accurate and verifiable information to users of accounting information. Representation of accurate information requires providing information when a book value of financial statements' elements corresponds to their economic value. Verifiability means that provided information can be verified and ensures that this value is set during a transaction (Barlev & Haddad, 2003).

The main obstacle of the fair value is insufficient reliability in the absence of an active market, which can adversely affect users' decisions. This deficiency of the fair value increases agency problems and allows managers to revalue the asset opportunistically. Margaret, Raar, Sofocleous and Ravlic (2007), Shamkuts (2010) believe that analysis of accounting information's qualitative characteristics – reliability highlights advantages of the cost's method over the fair value. Margaret et al. (2007) maintains that the main advantage of the historical cost is its credibility, because the sum of money that has been paid can be proven by transaction's documents. Based on actual transactions, sums indicated in documents are reliable, verifiable and not influenced by management's bias (Shamkuts, 2010). It is difficult to assess reliability in case of hypothetical transactions because they can not be objectively measured, which reduces reliability of the fair (Foster & Shastri, 2010). Stability of the historical cost increases its reliability, but at the same time causes the main criticism of the historical cost, since the historical cost depends on a stable monetary policy (Margaret et al., 2007).

Reliability level of the fair value reflects in the IASB defined fair value's hierarchy, whereby the data used to determine the fair value according evaluation methodologies are divided into three levels (see Fig. 1).

1st level: The fair value is based on the same asset or same liabilities quoted (unadjusted) market prices when there is an active market to that an entity might enter on the valuation date. This is the most reliable level.

2nd level: The fair value depends on directly and indirectly observable data about the asset or liabilities in the absence of an active market, excluding quoted prices that are classified as level 1.

3rd level: Data is unobservable data about the asset or liabilities.

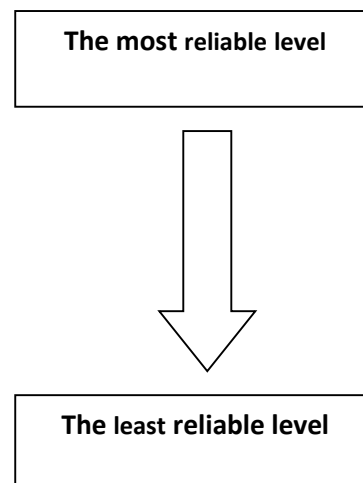


Figure 1. The fair value's hierarchy and levels of reliability (composed by the authors according to Shamkuts, 2010; 13 IFRS)

Figure 1 shows that the only level that can reflect and provide a reliable value to users of accounting information is the 1st level of the fair value (Shamkuts, 2010). The 2nd and the 3rd levels of the fair value enable the company to assess unobserved prices in the market by satisfying assumptions of assessors used to value the asset and liabilities. However, in the absence of an active market the evaluation process of the asset and liabilities becomes difficult, resulting in more errors in the evaluation process, reduction of reliability and verifiability of financial statements, increase of subjectivity of the evaluation process and probability of management's selfishness (opportunism), which generally increase agency problems (Christensen & Nikolaev, 2009). The 2nd and the 3rd levels of the fair value require more independence and competence from auditors, companies' management and assessors so that they can assess subjectivity and control effectiveness of management (Penman, 2007).

Opponents of the fair value argue that companies should use only the historical cost, because the fair value can reduce reliability of financial statements, but opponents ignore the fact that the fair value increases relevance of financial statements.

Some researches of the fair value focused more on reliability of the fair value than on its relevance. However, not all authors argued that the historical cost provides more reliable information. Muller and Riedl (2002) pointed out that evaluations by the fair value for external users of information are more reliable. Howe and Lippitt (2010) pointed out that in accounting a verified fair value should be used. They described the verified fair value as a combination of changes in value, which include changes in the value of liabilities and moments of their recognition, transformation and fulfilment (Howe & Lippitt, 2010). According to authors the verified fair value reflects the current value. The fair value arising from the verified fair value is comparable and consistent. In addition, they found that the verified fair value is the best evaluation measure, because it is transparent, practical, easily audited, verified and reliable. By using the

verified fair value it is possible to eliminate deficiencies of the fair value and to improve its advantages.

Comparability is defined as a quality of information that enables users to identify similarities and differences between two economic events (FASB, 1980). Mackevicius (2004) maintained that comparability of accounting data means that users of information have to be able to compare financial statements of different periods, as well as financial statements of different companies in order to assess their financial condition and results of activities. Comparability is important also because users of information can familiarize with company's accounting policies, according to which financial statements were prepared. Application of the fair value improves comparability of accounting information in all companies. Penman (2007) maintained that application of the fair value's method internationally could increase the comparability of companies' financial information. Emerson et al. (2010) believe that application of the fair value makes financial statements more comparable, because the fair value is an instrument, depending on the market rather than on a specific company. However, problems arise when an active market does not exist. Under these circumstances, comparability of financial statements can be doubted because fair values of the same asset in different companies may vary (Prochazka, 2011). Therefore giving of clear advices on how to assess the fair value is an important factor in ensuring comparability of financial statements prepared by the fair value. Comparability of financial statements prepared in the method of the fair value, where the fair value can be reliably determined, is strong (Shamkuts, 2010).

An interesting approach to the fair value provides Barlev and Haddad (2007) by analyzing the concept of the fair value in the aspect of international accounting harmonization. These researchers believe that the fair value is useful in the evaluation process of the asset and liabilities in order to create high-quality accounting data comparison, which is the main idea of international accounting harmonization. As application of the fair value promotes international accounting harmonization, the fair value is estimated as a catalyst in a cycle of harmonization. Researchers believe that international accounting harmonization prompts to provide more relevant accounting information, therefore efficiency of global markets is increasing and quality of accounting data based on the fair value is improving.

In summary it can be maintained that financial statements should provide useful information for potential investors and creditors by helping them to make economic decisions. Investment decisions made by investors affect distribution of income, as well as a level of welfare of people in the society, therefore such decisions should be based on relevance, reliability and timely information and positively contribute to the development of the country's economy. A debt is the main external source of financing in the capital market, so accounting information is relevant for creditors. Creditors (banks and other financial institutions) are interested in the company's financial condition and its potential timely to repay the loans with interest. Financial accountability provides creditors with information about debtor's level of risk, profitability, efficiency of management, a value of company's deposit. If accounting information accurately and timely provides creditors with information about company's financial condition, then such information may help to reduce information's asymmetry for creditors and to improve debtor's possibilities to get a loan and to pay less interest.

4. Conclusion

Theoretical studies enabled to formulate following conclusions:

Elements of financial statements can be assessed by various methods, based on the cost and the fair value. The fair value is evaluation based on market forces. The main accounting information's qualitative characteristics are as follows: understandability, relevance, reliability, comparability.

The fair value provides a more understandable, relevant, reliable and comparable accounting information than the historical cost. However, when there is no active market, understandability, relevance, reliability and comparability of accounting information evaluating according to the fair value, is disputed. In particular, the reliability of accounting information is questioned, because the analysis of accounting information's qualitative characteristics – reliability particularly highlights advantages of the cost's method over the fair value. However, despite the criticism, application of the fair value's method is the only possibility correctly to identify the value of financial statements' clauses, which is particularly relevant to users of accounting information when making optimal economic decisions.

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INVESTMENT FUNDS POSSIBILITIES FOR CROATIAN CITIZENS

Domagoja Buljan Barbača, PhD

*Department of Professional Studies, Univesity of Split, Split, Croatia
dobuljan@oss.unist.hr*

Branko Sorić, MSc

*Department of Professional Studies, Univesity of Split, Split, Croatia
bsoric@oss.unist.hr*

Ante Ćelić, BA

*Deltron, Split, Croatia
ante.celic@deltron.hr*

Abstract. Croatian citizens are faced with certainty of low retirement income to which they exercise the right based on saving in the first and second pillar. This is the result of extremely unfavourable demographic trends and prolongation of the life expectancy age. In these circumstances, awareness has developed of the need to raise funds to ensure financial security, protect living standards in retirement age and bridge the income gap that arises after retirement. Opportunities for the citizens of the Republic of Croatia exist, and one of the modalities is allocation of the saving in investment funds. The focus of this paper will be precisely this type of financial activity. Investing in mutual funds requires a certain level of financial literacy, but also the ability to cope with the risk that this type of financial activity inevitably carries. The extent to which differences in returns affect the choice of investment type will be investigated. All aspects of this type of investment with all the advantages and disadvantages will be analysed, and based on the obtained results, adequate recommendations will be made

Key words: *investment funds, retirement income gap, financial literacy*

1. Introduction

Unfavourable demographic trends in the last decades, in Croatia, have put a lot of pressure on the retirement system inherited from the former state. The collection of the money for retirement income was based exclusively on intergeneration solidarity, meaning that currently employed individual's payed contributions and from these contributions the state allocated pension payments. Unfortunately, with unfavourable demographical changes, loss of working places and the sudden increase in number of retired people after the Homeland war, this system was no longer sustainable. Relevant numbers of insured and retired persons, for period from 1990 to 2021, are presented in Table 1.

Table 1 The ratio of insured and pensioners in Croatia

Year	Insured persons	Retired persons	Ratio
1990	1.968.737	655.788	3:1
1995	1.567.981	865.769	1.81:1
2000	1.380.510	1.018.504	1.36:1

2005	1.498.877	1.080.571	1.39:1
2010	1.475.363	1.200.386	1.23:1
2015	1.413.637	1.135.166	1.25:1
2021	1.571.672	1.232.601	1.28:1

Source: Authors calculation according to the data from Croatian Pension Insurance Agency (CPIA)

From the data presented in Table 1 we can see that the number of insured people in Croatia was rapidly decreasing and from 2015 there is slight recovery in terms of the number of insured people. On the other hand, the number of retired people increased rapidly until 2010 and from 2010 we can see a slight decrease. From our analysis of the contemporary issues in the Croatian pension system the most important indicator is the ratio between these two indicators.

Although the ratio of the last few years shows a slight improvement, we cannot say that the problems of lack of efficiency within the pension system are solved because if we are to interpret this ratio the real meaning is that one and a quarter worker's need to contribute to the pension system to sufficiently cover one retired person's monthly income. Since the 90's it has become clear that this unfavourable trend is here to stay, since the first reform of the pension system was induced.

The contemporary Croatian pension system consists of three pillars, which represent a combination of compulsory and voluntary pension funds. The first pillar represents continuation of intergenerational solidarity system, and all financial contributions allocated to this pillar are allocated for retirement income of current retired people. The second and third pillar are implemented as a part of the pension system reform induced in 2002. The structure of today's Croatian pension system is shown in Figure 1.

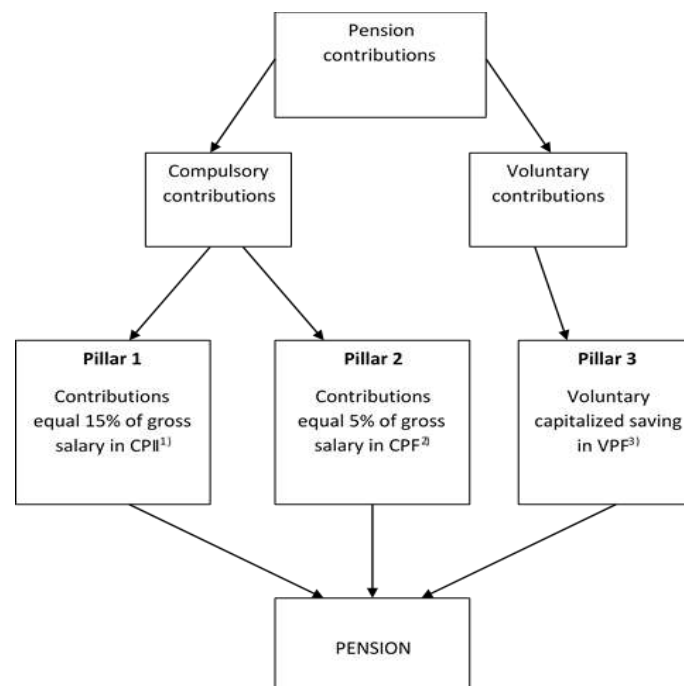


Figure 1 Croatia's pension scheme

Notes: 1) Croatian Pension Insurance Institute, 2) Compulsory pension fund, 3) Voluntary pension fund

From Figure 1 it is clearly visible that the pension contributions are divided into compulsory and voluntary pension contributions. Compulsory pension contributions are allocated in first two pillars. The first pillar is financed with 15% of employees' gross salaries. The second pillar is the pillar for the individual capitalized savings and amounts of up to 5% of employees' gross salaries are to be allocated. Voluntary pension contributions are to be allocated in the third pillar which is also based on individual capitalized savings. The projection is that once a person retires, a pension will be paid out from all three pillars.

If we consider that, the individuals will have to take care of their financial situation in the future it is very important which financial decisions they take today. Individuals are for the most part uninformed about financial products and unaware of financial performances of these products and therefore are not able to take the best investment decision for themselves. Beside general financial literacy we could say that citizens need to be "specialized" in pension literacy. (Vehovec M., 2011) The problem of financial literacy of the Croatian citizens should be approached as a major social challenge that can prevent poverty in the future. (Buljan Barbača D., Erak M., Jolić B., 2016) Under the statutory pension scheme (first pillar of pension insurance), you may receive your old-age pension when you have completed 15 years of qualifying period (men and women) and reach 65 years of age if you are a man. If you are a woman, you may claim your old-age pension in 2021 if you have reached 62 years and 9 months.

Although the reform of pension system has been performed in order to secure good income in retirement age, predictions made by several relevant institutions in different independent studies, show that predicted retirement income coming from first and second pillar will not be sufficient to protect poverty in retirement age. Most important is prediction of gross salary income vs gross retirement income. Data are presented in figure 2.

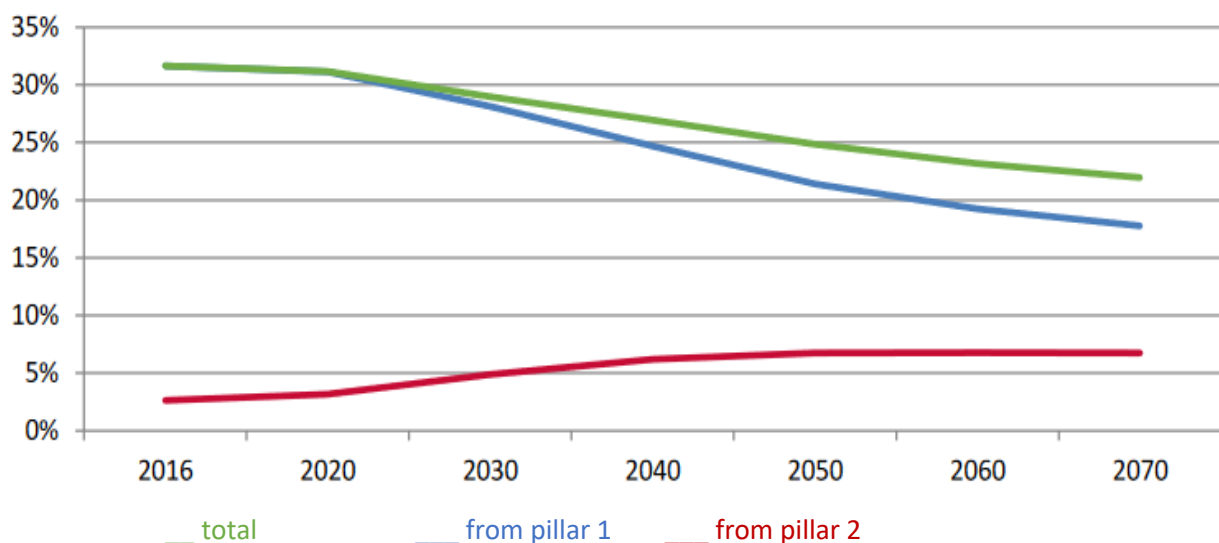


Figure 2 Projection of the ratio of average gross pension to gross salary income from 2016 to 2070

Source: World Bank Group (2019) Primjerenost mirovina u Hrvatskoj (Adequacy of pensions in Croatia).

As we can see from proposed projections future pensioners can expect huge gap from salary income to pension income that can influence greatly quality of life in retired age. Although these predictions are based on several assumptions, they have to be taken seriously from both, institutions and individuals in Croatia. Croatian Government, Croatian Pension Insurance Institute, Croatian Financial Services Supervisory Agency, Croatian Central Bank, Croatian Insurance Bureau and respectable number of financial experts gathered in different projects are trying to increase awareness of general public on this serious problem.

2. Long term investment possibilities for Croatian citizens

In order to prevent adverse scenarios in retirement age individuals need to grow additional financial capacity in working ages. Possibilities for Croatian citizens exist in for of different saving and investment products but limitation in form of low level literacy should also be considered.

Over the past two decades, the problem of low literacy levels, which various authors point out, has already become a burning interest of domestic authors and institutions. Results on financial literacy research performed on Croatian citizens (Ipsos, 2015) show that it is still low level literacy, although lot of different activities have already been undertaken such as: in 2009, the Croatian Insurance Bureau initiated cooperation with the Ministry of Finance on an initiative related to the "Financial Literacy" project, Government of the Republic of Croatia has adopted the first National Strategic Framework for Consumer Financial Literacy for the period 2015-2020. (OG 11/15), and in June 2021 a new document was adopted for the new period, National Strategic Framework for Consumer Financial Literacy 2021-2026 (OG 65/21), several commendable initiatives have been launched following the strategic document, such as the small school of financial literacy available to the Croatian Insurance Bureau on its website (HUO, 2021), Štedopis - Institute for Financial Education. a series of activities that he wants to contribute to raising the level of financial literacy of the population (Štedopis, 2021), but also many others independent financial experts who deal with this issue in the Republic of Croatia.

In this survey, possibilities of Croatian citizens to bridge financial gap that they will all have to face once they retire, will be analysed by investing options open for them on financial market.

2.1. Possibilities of investment for Croatian citizens

Croatian citizens are traditionally bank oriented. Most of the money accumulation flows into banks. This is partly the result of heritage, partly of insufficient financial literacy of citizens, but also of the fact that citizens deposits are insured by the state. However, since interest income on savings is at historically low levels, an increasing number of citizens are opting for other forms of investment. One of these is investments in the financial market, which offers numerous opportunities from investing in bond securities, to investing in equity securities to investing in financial derivatives. Citizens can build their own portfolio, but they need enough free money, knowledge and time to devote to it. For these reasons, most small investors choose to invest in various investment

funds managed by companies certified by Croatian Financial Services Supervisory Agency (HANFA), the regulator of the financial market in the Republic of Croatia. The choice of an individual investment fund is in direct correlation with the risk and return that an individual investment fund offers. It is based on the principle of utility, according to which the investor will achieve the maximum benefit in a way that achieves the maximum return for the risk acceptable to him.

An investment fund is a mutual investment entity whose sole purpose is to raise funds through a public or private offering and invest those funds in various types of assets in accordance with a predetermined investment fund investment strategy, and exclusively for the benefit of the unit. (Narodne novine, 2016). The advantage of investment funds is in lower costs than those of an individual investor, since the knowledge gained in the market will be applied to the entire investment of the fund and thus take advantage of economies of scale. In addition to lower costs, the advantages of investment funds are investment diversification, professional management, the ability to achieve higher returns compared to traditional forms of savings, easy buying and selling of shares, investor protection, availability of information about funds and trust (Mishkin, F., Eakins, S., 2005). Investment funds act as one of the most important intermediaries in the capital market. Their importance and efficiency are more pronounced in countries with more developed financial systems and more developed capital markets (Perčević, H., Mićin, M., 2017). Investment funds are considered the initiator and one of the most important indicators of capital market development (Investment funds have a greater ability to collect dispersed savings of monetary surplus entities than traditional deposit-lending financial institutions because their units or shares are adjusted to different categories of investors, and in addition they provide investors with low diversification costs and professional management services (Gulin, D. 2001), For many investors (especially the so-called small ones with insufficient knowledge of investment analysis and financial market), it is much more efficient to invest in units and shares of investment funds than to form their own portfolio with various financial instruments (Brealey, R. A., Myers, S. C., Marcus, A. J. 2004).

Open-end Investment Funds with a Public Offering (UCITS) and alternative investment funds operate on the Croatian financial market. The funds raised are invested by UCITS funds in transferable securities according to the principles of risk sharing. Units in UCITS funds are redeemed at the request of investors from the assets of that fund. Alternative investment funds can raise funds through public and private offerings and have the opportunity to invest in riskier forms of assets.

Mutual funds have different investment strategies. The most common investments are in company shares (equity investment funds), in government and corporate bonds (bond investment funds), in money market instruments (money investment funds) and in combinations of shares, bonds and money market instruments (mixed or balanced investment funds).

Equity funds offer the riskiest type of investment, but also provide the opportunity to make the biggest profit. Mixed funds are riskier than bond investment funds but offer the possibility of higher returns than bond funds. Bond funds are intended for more conservative investors, they are less risky than those mentioned above, but they therefore provide greater security to investors. Monetary funds are low-risk investment

funds, especially if they invest in government short-term securities such as treasury bills. Accordingly, they offer a low and relatively safe return to investors.

Alternative investments in a broader sense are forms of investment outside traditional forms of investment such as stocks, bonds or cash. In practice, alternative investments consist of investments in privately held and unlisted companies as private equity, investments in new promising companies through venture capital. Fund investments in real estate and metals can be classified in the category of alternative investments (Ilić, M. 2017).

Investing in venture capital is considered to be investing high risk, but also high profits. Venture capital investment encourages the development of those companies that can never or very hardly borrow from banks or by issuing equity securities. Investing in the risk capital of a company is a long-term investment, which brings with it a great return, but also a great risk (Prtenjača Mažer, K. 2019). This type of investment is most common in the United States, while in Europe, and especially in the countries of New Europe, it is very rare. Given the complexity of the risk, alternative investments, as a rule, are not intended for smaller investors, but for the so-called accredited investors based on regulatory frameworks in individual countries (Cornelius, P. 2011).

2.2. Analysis of the success of funds in the Republic of Croatia

At the end 2021, there were 93 active open-ended investment funds with public offering in Croatia which is 3 less than in 2020. Their total Assets amounted to 21.5 bn, which represents 18,1% increase compared to the previous year. It should not be forgotten that 2020 was a pandemic year and that the pandemic is still ongoing, so it is not surprising that although financial markets showed the fastest and strongest response to the pandemic, net assets shown a decrease compared to 2019.

If we look at the structure of UCITS funds, we can conclude that most of the assets still belong to the bond funds participating in the total assets with 70%. Observing bond funds their assets also increased of 5,98% compared to 2020. Asset of equity fund stood at 2.4 bn, accounting for 11.2% in the structure of total assets of UCITS.

Regarding annual returns the greatest progress is on the side of equity funds. Since stock markets recovered with the greatest price adjustments, equity funds concluded 2021, as expected, with a relatively big positive yield. The best among them was Capital Breeder equity fund with annual return 36,05%. It is important to note that only two equity funds ended the year with a negative annual return.

Table 2 Investment funds net assets (At the end of period, in thousand HRK)

	2017	2018	2019	2020	2021
UCITS funds	18.499.606	19.117.229	22.577.123	18.216.156	21.512.344
Money	8.671.882	7.082.940	8.070	-	-
Bond	6.261.893	8.700.110	18.422.580	14.155.498	15.059.757
Balanced	884.054	848.292	986.039	952.503	1.457.474
Equity	1.913.771	1.597.766	1.806.191	1.664.233	2.429.716
Feeder	-	19.304	15.161	114.547	431.583
Others	768.006	868.817	1.339.081	1.329.375	2.133.814

Source: Authors calculation according to the data from HANFA publications

Most of the assets of UCITS fund in 2021 continued to be invested in domestic debt financial instruments, despite the fact investment in foreign markets increased 28,46% compared with 2020. Following the previous years, the largest part of investment in the domestic market was government bonds (72,15% of all domestic investments). Investments in foreign assets primarily related to investments in bonds, followed by shares, and to a lesser degree, investment funds.

In the period from January 1 to December 31, 2021, 67,686 new members joined the OMF, or an average of 5,641 members per month, which is 14.21% more than in the same period in 2020, when a total of 59,267 new members joined the funds or an average of 4,939 members per month.

In the period I-XII 2021, out of the total number of new members (67,686), 65,175, or 96.29% of REGOS were ex officio assigned to one of the OMFs, while 2,511, or 3.71% of new members in person reported to the OMF. In the same period in 2020, out of the total number of new members (59,267), the schedule covered 95.92% (56,851) of new members, and personal applications covered 4.08% (2,416) of new members. (<https://regos.hr/podrska/statisticki-pokazatelji/statisticki-pokazatelji-za-2021>)

According to data from Regos, in 2021, only 3,71% of members selected their mandatory pension fund by themselves, while the rest were allocated under the legally prescribed schedule. This indicates the need to better inform current and future members of pension funds about the functioning of pension system, the categories of pension funds and differences between them, and the possibilities to choose a pension company and fund category. Because of all mentioned in 2020 HANFA adopted the Guidelines for pension companies on increasing the level of financial literacy of Croatian citizens. All of efforts taken by pension companies led to a significant progress in making Croatian citizens familiar with topics related to the pension system.

Table 3 Pension funds net assets (at the end of period, in thousand HRK)

	2017	2018	2019	2020	2021
Mandatory pension fund's category A	589.546	652.895	828.563	985.366	1.443.154
Mandatory pension fund's category B	87.374.803	92.633.969	106.119.593	110.813.741	122.596.702
Mandatory pension fund's category C	3.960.196	4.839.330	5.649.949	7.268.951	8.944.373
Total mandatory pension funds	91.924.545	98.126.194	112.598.105	119.068.058	132.984.229
Open-ended voluntary pension funds	3.895.569	4.231.346	5.119.466	5.542.772	6.420.544
Closed-ended voluntary pension funds	849.556	908.054	1.101.694	1.198.075	1.384.181
Total voluntary pension funds	4.745.125	5.139.400	6.221.160	6.740.846	7.804.724
Total	96.669.670	103.265.593	118.819.265	125.808.905	140.788.953

Source: Authors calculation according to the data from HANFA publications

At the end of 2021 net assets of pension funds amounted to 140.79 bn and were 11,9% higher than in 2020. As we can see all mandatory funds recorded a significant increase

over the year before. The majority of pension system members belong to category B mandatory pension funds whose investment strategy is fine balanced with risk taken on the other hand. For that reason, most of the net assets also belong to mandatory pension fund category B, a bit over 92%. Apart from mandatory pension funds, voluntary pension funds also recorded growth in 2021. Total net assets of voluntary funds stood at 7.8 bn or an increase of 15,7%.

Most of the investments of category A mandatory pension funds are made in shares and government bonds. Category B mandatory pension funds investments mainly consisted in domestic market mostly government bonds with 76,8% of all domestic investments. Significantly larger amounts were invested in UCITS, making up 92.6% of all investments in investment funds, while AIFs accounted for only 7.4% Category C mandatory pension funds investments are mostly made in governments bonds on domestic market.

Voluntary pension funds, as well as mandatory ones, primarily invest most of their assets in domestic government bonds whose price is less volatile compared to equity investments. However, a good part of the assets is also invested in shares on the domestic market. At the end of 2021 Shares and GDRs stood 1.1 bn which is 25% of all purchases on domestic market.

As we can see in table 4 all categories of mandatory pension funds achieved positive returns in 2021. The results are like those before the pandemic, especially in funds category A and B.

Annual return of voluntary funds in 2021 ranged from -0.30% to 13.45%. If we compare these annual returns with the year before we can see positive result, considering that the average annual return in 2020 was only 0,2%.

Table 4 Mandatory pension funds annual rates of return

	2017	2018	2019	2020	2021
Mandatory pension fund's category A	+4,57%	+0,84%	+13,22%	+0,43%	+13,52%
Mandatory pension fund's category B	+3,06%	+1,02%	+9,04%	+0,94%	+7,37%
Mandatory pension fund's category C	+6,08%	+2,94%	+5,43%	+1,15%	+0,43%

Source: Authors calculation according to the data from <https://hrportfolio.hr/prosirena-tecainica>

3. Differences in returns and the choice of investment

In order to decide in which fund to invest we need to think about several factors. The age of the investor, the investment goal and the risk appetite. Therefore, the investment plan needs to be adjusted to your own needs. If you are happy to take on a relatively high level of risk, you might want to buy a fund that is purely invested in shares. If you want to tone down the risk, you might want to buy a fund invested in a mix of different asset classes, such as bonds. Also funds that invest in large companies that are already successful are usually seen as lower risk than funds investing in small, upcoming companies that are more likely to fail. Some funds invest purely in companies based in developing countries (called emerging market funds). Investing in these regions would usually be deemed as higher risk because their economies tend to be more fragile.

If the investor is conservative and we are talking about a long-term investment plan, he will certainly buy shares in a mixed or bond fund. An aggressive investor chooses only equity funds for a longer period and increases level of security by choosing funds with a geographically different investment strategy.

It is important to explain two concepts related to the level of risk. Value at Risk (VaR) is a financial metric that estimates the risk of an investment. More specifically, VaR is a statistical technique which is usually used to measure the amount of potential loss that could happen in an investment portfolio over a specified period. It is used to measure the market risk to which the portfolio is exposed. The confidence interval used in the calculation is 95% and a period is one month. If we look at a portfolio worth 10,000.00, and the risk value of that portfolio is 5.00 percent, it means that the owner of the portfolio in a period of one month, under normal market conditions, with a probability of 95% can expect that the value of his portfolio will not fall by more than 500.00.

Other one is synthetic risk and reward indicator (SRRI) which is used to indicate the level of risk of a UCITS fund by providing a number from 1 to 7, with 1 representing low risk and 7 representing high risk. The intention of the UCITS directive was to make understanding the risks and possible rewards of a fund as simple as possible.

Table 5 Difference in total assets based on fund selection (one time investment)

Fund name	Type of fund	Average annual return last 5 years (%)	One time investment	Period (yrs)	Assets at the end of the period
ZB trend	equity	13,26	100.000,00	5	186.372,91
Eurizon HR Global fond	balanced	3,69	100.000,00	5	119.862,79
InterCapital Bond - klasa B	bond	0,66	100.000,00	5	103.343,85

Source: Authors calculation

Table 6 Difference in total assets based on fund selection (monthly payments)

Fund name	Type of fund	Average annual return last 5 years (%)	Monthly payments	Total invested	Period (yrs)	Assets at the end of the period
ZB trend	equity	13,26	2.000,00	120.000,00	5	165,619,00
Eurizon HR Global fond	balanced	3,69	2.000,00	120.000,00	5	131,359,00
InterCapital Bond - klasa B	bond	0,66	2.000,00	120.000,00	5	121,962,00

Source: Authors calculation

Why it is important to choose an investment fund well, we can see clearly from table 5 and 6. Although we took a relatively short period as a sample, there was a huge difference in assets at the end of the fifth year. Average working life in Croatia is 32 years and the difference in assets at the end of working life would be even more

pronounced between bad investor and great personal finance manager. For example, if we pay monthly amounts of 2.000,00 in ZB trend equity fund with average annual return in last five years 13,26%, asset at the end of five-year period will be 165.619,00. On the other side if we pay monthly amounts of 2.000,00 in InterCapital Bond-klasa B bond fund with average annual return in last five years 0,66%, asset at the end of five-year period will be 121.962,00. When we compare these two investments, we can see that there is a huge difference in total asset thanks to different rates of return. However, we shall not forget that there were also different risk indicators of the investment.

Each investor needs to establish a plan, understand risk, diversify for successful long-term investing and review strategy regularly.

4. Conclusion

Croatian citizens will be facing lot of financial challenges in retirement age. On the Croatian financial market they have various possibilities to build financial capacity that will help them bridge the gap between salary and retirement income. Results of performed research show, undoubtedly, that awareness of necessity to invest is increasing in observed period. Still, majority of citizens engage their assets in banking saving which has been explained as a result of traditional belief that the banking institutions are more safe than all the other financial institutions.

Nevertheless, some positive trends, regarding changes in investment habits, are to be noted.

Due to the scarce data on Croatian citizens' financial behavior some strong conclusions cannot be made without new, substantial research. Further analyzes are to be performed on reasons why citizens invest more into financial instruments that are obtaining less return on payment.

The further efforts should be focused on increase of the level of financial literacy of Croatian citizens, increase of understanding risk and further development of regulatory frame that will protect citizens from different frauds present on all global financial markets. Challenges of the uncertain financial future of general public can also be decreased by growth of offer diversity that will give more possibilities for successful long-term investing and creation of diversified investment strategy.

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TAX PLANNING, VALUE ADDED TAX (VAT) OPTIMIZATION AND TAX CONTROL

Ante Mrčela

University of Split, University Department of Professional Studies, Kopilica 5, 21000 Split,
Croatia
amrcela9@gmail.com

Silvana Zovko Marić

Ministry of Finances, Av. Dubrovnik 32, 10000 Zagreb
silvana.zovkomaric@gmail.com

Damir Piplica

University of Split, University Department for Forensic Sciences, R. Boškovića 33, 21000
Split, Croatia
damir.piplica@unist.hr

Abstract. Tax expense makes up a significant part of the company's total costs, which are directly related to the company's competitiveness on the market. Besides direct costs, tax burdens also create indirect costs because increasingly complex tax regulations demand specific and specialized knowledge as well as being familiar with them.

Research of existing Croatian practice through appropriate case studies will confirm the thesis that tax planning and optimization are finding ways to reduce tax payments, and at the same time have a role in achieving tax savings through various opportunities for tax relief and other savings. The aim of the research is to show based on concrete case studies the application of the scientific approach in tax planning. The obtained results show that ignorance and misapplication of legal regulations can lead to significant expenses in the form of penalties for committing a tax offense or even a possible criminal offense.

Therefore, entrepreneurs can achieve savings in paying taxes only if they correctly apply tax regulations through tax optimization and planning and at the same time, they can reduce the risk of reckless entry into the area of tax avoidance. It is, therefore, important to be well acquainted with the tax system and tax regulations, but also with the procedures and legal possibilities in the case of tax supervision, through which proper tax planning is controlled.

VAT optimization is a complex process and involves the use of various methods, approaches, and strategies to achieve a useful result without ultimately looking like an attempt to avoid paying taxes. Knowledge of tax reliefs and exemptions enables efficient tax planning and facilitates the company's management to make optimal business decisions. Tax revenues make up a significant part of state budget revenues, which makes the controlling in this area of tax planning and optimization frequent, thorough and comprehensive.

Key words: *tax planning, tax optimization, tax liabilities, VAT, tax supervision.*

1. Introduction

Taxpayers of the Republic of Croatia and other countries are taxpayers of various tax forms, and the aim of each taxpayer is to reduce their tax burden as painlessly as possible, while at the same time increasing their income, and all the while staying in compliance with legislation. Therefore, the thesis is that tax planning and optimization

are finding ways to reduce tax payments, and at the same time have a role in achieving tax savings through various opportunities for tax relief, etc. The best way to confirm this thesis is through appropriate case studies from the best practice examples in Croatia. Thus, taxpayers can successfully use tax planning to achieve the set goal.

Value added tax is only one form of taxes to which taxpayers are subject given the level of its tax rate, the goal and priority of taxpayers is how to reduce tax payments and how to optimize liabilities. Special attention in tax planning and optimization is focused on value added tax because it is the most generous tax in the Republic of Croatia, and the one avoided the most by taxpayers. On the other side the state bodies control, this tax the most as it is most susceptible to tax evasion.

2. Tax planning

2.1 The concept of tax planning

The functioning and survival of modern states would not be possible without revenues, which finance public expenditures, and these revenues are collected through taxes. Piplica (2020) thought that most taxpayers are aware of the need to pay taxes for the common good, but this does not mean that it is always done with joy or with the desire to leave more money for themselves or a company of personal interest. Lakhotia and Lakhotia (1998) concluded that tax planning benefits from the deductions, rebates, etc, allowed by tax laws, leading to a reduction in taxpayers 'tax liability. Among other things, coercion is something that characterizes taxes, which results in a negative attitude of taxpayers towards the fulfilment of these obligations "Although most taxpayers are aware of the need to pay taxes for the common good, it does not always mean that they are happy to do it or wish to leave more money for themselves or the company out of personal interest." (Jelčić et al., 2002). Scholes and Wolfson (1992) thought that traditional approaches to tax planning didn't distinguish effective tax planning and tax minimization as two different concepts. Wahab & Holland (2012) have defined tax planning as all activities which have a goal to produce a tax benefit. Desai et al. (2009) measured tax planning as total accrued tax differences controlled for total accounts. Chen et al. (2010.) have concluded that tax planning is a real investment for shareholders.

Taxes are, therefore, duties forced upon the citizens and societies by the states, and they date back to the distant past. Even in ancient civilizations, there were various forms of levies, obligations that forced the population to give part of their goods or crops to the ruler. With the creation of strong states, they are increasingly relying on tax forms, and this also leads to resistance to paying tax. Tax planning therefore appears as resistance to the obligation to pay taxes, levies, and fees, to reduce these obligations. And it is therefore that the modern man resorts to rational thinking and more detailed planning of how to achieve business goals with optimal tax performance, all the while staying within the legal framework.

However, taxation exists for the benefit of society as a whole and as members of society we all together gain certain benefits, these benefits are costly and the only way to afford them is through taxes. Tax planning therefore allows taxpayers to harmonize their operations to reduce tax liabilities within the framework of tax regulations (Tomaš, 2018). It is a process that involves the use of various tax exemptions, deductions, and

benefits to reduce the tax burden during the year. To achieve this, it is necessary to have a proper understanding of tax laws, but also their application in the right situation and in a correct manner.

Certainly, taxes can be a significant expense for financially successful companies, so tax planning is financial planning because the goal is to reduce tax liabilities and make optimal use of benefits and advantages by applying favourable provisions of tax laws. One of the advantages of such planning, in addition to the reduction of tax liabilities, is that refunds can be directed to new investments, which ultimately helps the economic well-being and development (Nikolić, 1999).

The basic tax forms in tax planning are personal income tax, corporate income tax, real estate transfer tax and value added tax. Thus, while following the tax laws and regulations, tax planning uses tax exemptions, deductions, reliefs, or refunds to be fully utilized or used in deferment or deferring liabilities for a later period. However, tax planning is not the same as evasion, i.e., avoidance to pay tax.

2.2 Tax avoidance and evasion

Avoiding paying taxes or tax evasion is one of the main factors that describe the behaviour of taxpayers and arises as a result of resistance to tax liabilities (Mahović-Komljenović,, 2009). Tax evasion is an illegal act or certain omission that avoids or conceals a tax liability. This is undesirable behaviour for the state because it leads to a lack of revenue for the state from tax collection in the amount of unpaid taxes, therefore there is a desire to minimize tax evasion or avoidance

There is a distinction between legal or permissible evasion, which is not in conflict with the law, and illegal or impermissible evasion, which entails sanctions.

Legal tax evasion is not in conflict with the law and other regulations and may be the result of finding “holes” in the legislation due to possible opacity or due to ambiguities in the legislation and the tax system. In general, taxpayers want to use these anomalies or ambiguities or inconclusiveness in different ways to show their revenues as low as possible and their expenditures as high as possible, thus reducing the tax burden and ultimately paying less taxes to the state. Changing the place of seat of economic activity or residence for natural persons is also a form of legal tax evasion. Due to different tax benefits in a particular territorial unit, lower tax rates in different cities or areas, taxpayers’ resort to the so-called tax escape. Increasing the tax burden on certain products to reduce their consumption or increase exports is also a form of legal tax evasion.

Illegal tax avoidance or tax evasion occurs when a taxpayer directly violates tax provisions and acts illegally while performing an economic activity. In the case of complete tax evasion, the taxpayer does not report any of the realized turnover, income, or assets, which is certainly subject to taxation. In the case of partial tax evasion, the taxpayer submits incomplete, partial, or false declarations or financial indicators of his turnover, income, and property value to reduce the tax base and thus lower tax. It is certainly necessary to point out that tax evasion is a criminal offense

The difference between tax planning and tax evasion is, among other things, the fact whether the transaction under observation is real or simulated, or fictitious, which means that its ultimate purpose is solely to avoid paying taxes. According to the General Tax Law, Article 12, if a legal transaction is concealed by an apparent legal

transaction, then the basis for determining the tax liability is a concealed legal transaction.

So, if there are two legal transactions and one of them serves only to conceal or to create a false impression, especially with the tax authorities, the basis for taxation is the other, concealed. Article 12a of the same Law describes the use of tax benefits contrary to the purpose of the law in such a way that a taxpayer who realizes tax benefits using the tax system through organizational forms that are taxable at lower prescribed rates, and which were not intended for a particular group of taxpayers, is using tax benefits contrary to the purpose of law. The difference between tax planning, tax avoidance and evasion are shown in the following diagram:

Table 1 Difference between tax planning, tax avoidance and tax evasion

Illegal	Legal	
Tax evasion	Tax avoidance	tax planning
Tax fraud	fraus legis – doctrine of the abuse of law	minimal or no tax liability
tax liability and	possible tax liability	there are no sanctions

Source: Kukić N. Introduction to Tax Planning – basic concepts and sources of law, RRIF no 12/2008

The right side of the diagram is an area that is not of interest to the tax authorities because it signifies completely legal tax evasion, for example giving up smoking hence avoiding the obligation to pay excise duty on tobacco products. Left side shows unacceptable behaviour and leads to tax liability and criminal responsibility. The most difficult part is in the middle: to define whether it is a matter of deferring tax liabilities or is the tax avoidance or tax evasion allowed.

2.3 International tax planning

International tax planning is a set of techniques of multinational companies that implement them to increase profits by reducing the tax burden. (Tomaš, 2018). When creating a tax strategy, multinational companies compare certain factors with companies in the same industry to design their own tax planning and select an appropriate tax strategy: as an allocation or relocation strategy and a strategy focused on home jurisdiction. (Tomaš, 2018).

A revenue transfer strategy is a form of legal tax avoidance that also brings long-term benefits to the company. In the strategy focusing on home jurisdiction, the concentration is hence on jurisdiction where the parent company has its headquarters.

To implement these strategies, certain techniques are used, such as:

- techniques aimed at deferring tax payments or making temporary savings and aimed at permanent savings,
- actual and formal tax planning
- techniques for using / not using double taxation agreements

3. VAT optimization

Tax planning is, as already mentioned, a method of reducing the tax burden and includes all available tools and resources that comply with legal provisions. The main goal of tax planning is to reduce the tax liability by using all favourable provisions in law such as deductions, exemptions, reliefs, rebates, etc. Therefore, tax optimization plays an important role because it enables significant savings in business operations and reduces the risk of illegal tax avoidance. Hence it is primarily important to know the tax system and certainly the legal provisions of each type of tax, depending on where the optimization is sought. Tax planning is carried out in direct and indirect taxes. An indirect form of taxation is value added tax (hereinafter VAT).

For optimization to give the best results, it is necessary to use several methods and strategies, and yet it should be borne in mind that everything is in accordance with legal provisions because the use of methods to optimize VAT is often subject to tax authorities' control, tax inspection. Optimization can be performed on a one-time basis for example, for one transaction or a shorter period (one accounting period), it can also be planned for a longer period or used every time when calculating and paying taxes (this implies good knowledge of tax exemptions, types of goods and services that are subjected to transaction, country where the business is conducted, etc.). VAT optimization methods may include using options, trading real estates, deposits, delaying invoicing or declaring the right to recognize pre-tax rights, establishing a subsidiary or several business units, etc. Before using any of the methods, the company must first decide what are the goals of each chosen method and be well informed of the legal provisions, because many of the methods, a company may choose to apply, are subject to and penalized if they are not implemented within the allowed framework.

3.1 VAT – basic concepts

With the accession of the Republic of Croatia to the European Union on the 1st of July 2013, the Value Added Tax Act was fully harmonized with the Acquis Communautaire in the field of value added tax taxation. This harmonization is related to the implementation of Council Directive 2006/112/EZ of the 28th of November 2006 on the common system of VAT, which entered into force on the 1st of January 2007, including all its amendments, the direct application of European Union Regulations and respecting the judgments of the European Court of Justice.

Value added tax is an indirect tax that the person who pays it transfers to another, the final consumer. It is regulated by the Value Added Tax Act (hereinafter: the Act).

According to the Act, the taxpayer is any person who independently performs any economic activity, regardless of the purpose and result of performing the activity. Economic activity is any activity of a producer, trader or person performing services, including mining and agricultural activities and activities of free professions, exploitation of tangible or intangible assets for the purpose of permanent income generation. In addition to these “regular” taxpayers there are also “occasional” taxpayers who are any person who occasionally delivers new means of transport to a customer in another Member state.

The subject of VAT taxation is the supply of goods and services in the country for a fee, the import of goods and the acquisition of goods within the European Union that is performed in the country for a fee. Article 5 of the Value Added Tax Act stipulates what is not subject to VAT. The Act further stipulates a taxable event as an event based on which the legal conditions necessary for the occurrence of the obligation to calculate VAT are met. It is important to point out accordingly that a taxable event is, among other things, the supply of goods or services, acquisition of goods within the European Union, import of goods, use of goods or services for purposes other than business and the like. VAT shall become chargeable when the tax authority, based on the VAT Act, has the right to claim VAT from the person who is obliged to pay it, even though the time of payment has been postponed.

Another of the basic concepts provided by the Act is certainly the tax base. The tax base for the supply of goods and services is the fee that is all that the supplier has received or should receive from the buyer or another person for these supplies, including the amount of subsidies directly related to the price of delivered goods or services. The tax base includes the amount of taxes, duties, fees, and similar levies, excluding VAT, also ancillary costs such as commissions, packaging, transport, and insurance costs charged by the supplier of goods or services to the buyer or seller.

The moment when the obligation to calculate deductible VAT arises is also the moment when the right to deduct VAT or input tax arises. The conditions under which a taxpayer may deduct input tax are determined by Articles 58, 59, 60, 61 and 62 of the Value Added Tax Act.

3.2 VAT exemptions as optimization elements

One of the areas that allows companies as taxpayers to plan for tax optimization are the exemptions applied by the states. As one of the approaches in the taxation of sales of certain products and services in the VAT system, where some of them are exempt for export (according to the principle of destination), because they are an important part of expenditure (e.g., food) or are good for the wider social community (education). Zero rates or exemptions are usually used for exclusion. Value Added Tax Act stipulates the exemptions described in Articles 39 to 56, which include:

- exemptions for certain activities of public interest,
- exemptions for other activities
- exemptions for transactions within the European Union,
- import exemptions
- export exemptions
- exemptions from the provisions of services on movable property
- exemptions in respect of international transport
- exemptions for certain deliveries equivalent to exports,
- exemptions for mediation services,
- exemptions for transactions relating to international trade

However, it should be borne in mind that when supplying certain goods and services that are exempt from VAT, the taxpayer is not entitled to deduct input tax, so input tax charged in the previous stage of turnover cannot be deducted. If the taxpayer makes partly exempt supplies and partly not exempt, he is entitled to deduct input tax only in the part relating to taxable supplies.

Value Added Tax Act also stipulates special taxation procedures. One of them is a special taxation procedure for small taxpayers prescribed to simplify and facilitate the fulfilment of their tax obligations. From the 1st of January 2018, the threshold for entry in the register of VAT payers is in the amount of HRK 300.000,00. Until the specified amount is exceeded, such taxpayer is exempt from VAT on supplies of goods and services but is not entitled to input tax. If a small taxpayer requests entry in the register of VAT payers, he is obliged to remain there for the next 3 years (Article 90 of the Value Added Tax Act). In practice, it often happens that some taxpayers abuse this institute precisely because they wish to avoid the payment of value added tax and the entry into the register of taxpayers, so instead of crossing the threshold the present company is closed, and a new one is opened. This, of course, is in the category of illegal planning or abuse.

For taxpayers with a registered office, permanent business unit, residence, or habitual residence in the country whose value of supplies of goods and services in the previous calendar year did not exceed HRK 15.000.000,00 excluding VAT, the procedure of taxation according to collected fees is provided.

This means that such a taxpayer can calculate and pay VAT based on fees charged for the delivery. This procedure is not mandatory but is a matter of the taxpayer's choice. The obligation to calculate VAT under this procedure arises on the day of receipt of payment, while the taxpayer has the right to deduct input tax at the time when he has paid the invoice to the supplier (Article 125 of the Value Added Tax Act).

4. Tax inspection

4.1 The concept of tax inspection

Tax inspection is part of the tax – legal relationship in which the Tax Administration and the Customs Administration, as well as other tax authorities carry out the procedure to verify and establish the facts relevant for the taxation of taxpayers and other persons. Tax inspection is therefore a tax procedure in which the facts relevant to taxation are established (Radusin Lipošinić, 2018), It shall be carried out within three years from the beginning of the limitation period of the right to determine the tax liability, exceptionally in case of abuse of rights, in procedures for determining the difference between acquiring property and proven means for acquiring that property, procedures for combating tax fraud and procedures ordered by other bodies, when tax inspection may be performed for a period for which the right to determine the tax liability has not expired (six years).

4.2 The course of tax inspection

Tax inspection is carried out to protect the public (tax) interest; therefore, it is prescribed that the tax authority has the right to subsequently verify the facts relevant to determining the tax liability that the taxpayer stated in the tax form. Verification of the stated data and determination of facts is carried out with the help of various means of evidence. What kind of means will be used and to what extent is the decision of the tax authority and the person conducting the tax procedure, guided by the basic principles of taxation prescribed by the General Tax Act and the General Administrative Procedure Act. During the period of tax inspection, the taxpayer must provide access

to all original documentation that is requested and is the subject of tax inspection, in order to properly establish the facts. In doing so, the tax inspector is obliged to establish all the facts that are important for making a lawful and correct decision, also considering those facts that are in favour of the taxpayer (Article 6 of the General Tax Act). Therefore, the obligation of the tax inspector, in addition to considering the facts that affect the increase in tax liability, is also to consider the facts that affect the reduction of tax liability. To determine all relevant facts for taxation, the tax inspector collects information, appoints experts, obtains documents, conducts inspections, and uses other evidence to decide on the correctness of taxation in a lawful and proper manner. Although the duration of tax inspection is not legally prescribed, the efficiency and cost-effectiveness should be considered. In establishing the facts, the tax authority bears the burden of proof for the facts that establish the tax, while the taxpayer bears the burden of proof for the facts that reduce or abolish the tax (Article 88 of the General Tax Act). If during the implementation of the tax inspection, it is determined that to make the right decision it is necessary to obtain information from taxpayers from other EU Member States, it may be proposed to conduct comparative inspections. The implementation of comparative inspections in the Republic of Croatia is prescribed by Article 37 of the Administrative Cooperation in the Field of Taxation Act in which Directive 2011/16/EU (for direct taxes) and Council Regulation (EU) No. 904/2010 (for VAT) are implemented. The aim of comparative inspections is the exchange of information carried out by authorized officials of the competent authorities of the Member States participating in comparative inspections.

Before completing the tax inspection or before compiling the record, the final interview is conducted with the taxpayer, on which an official note is drawn up. In the final interview, the taxpayer must be informed of all the facts established during the inspection, legal assessments and conclusion reached including their impact on the determination of the tax liability. Disputable matters should certainly be discussed. After that, a record is made and handed over to the taxpayer. The taxpayer has the right of filing a complaint regarding the record. If the complaint contains new facts and evidence acceptable to the tax authority, an additional record shall be drawn up.

To the complaints that are not acceptable, the answer shall be included in the tax decision, which determines the taxpayer's obligation and orders payment. According to the given instruction on legal remedy, the taxpayer has the right to file an appeal against the tax decision. The appeal of the taxpayer can be accepted in the first instance, from the body that issued the tax decision or, if the allegations are not accepted, it is submitted to the second instance body for competent action. The appeal postpones the execution of the decision.

5. Examples of tax planning

5.1 Example of tax planning for which evasion has been determined

Taxpayer A d.o.o. is a company founded in the year 2000 and is engaged in construction and trade. It is a taxpayer of corporate income tax and value added tax as a monthly taxpayer. From the 1st of January 2015 the company becomes a taxpayer

for the fees collected. Pre-bankruptcy settlement proceedings against debtor A d.o.o. opened in 2017. The company then establishes a new company B d.o.o. in June 2018 where the responsible person is the same as in the company A d.o.o. Company A d.o.o. decides to sell real estate, a piece of land, to continue the construction activity through the new company (subsidiary B d.o.o.) since the company A d.o.o. got into financial trouble. Pursuant to the Article 40, paragraph 1, items j) and k) of the Value Added Tax Act, VAT is exempt on supplies of buildings or their parts and the land on which they are located, except for supplies before the first residence or use or deliveries with which from the first settlement or use did not take more than two years until the date of the next delivery, and the delivery of land, except for construction. Paragraph 4 of the same Article stipulates that the taxpayer has the right to choose the tax supplies referred to in the sited Article and items j) and k) provided that the buyer is a taxpayer entitled to deduct input tax in full based on the supply to which the right of taxation wants to be applied. The right of choice for taxation and the right to deduct input tax may apply at the time of delivery.

Taxpayer company A d.o.o. decides to sell, with the VAT calculation, since the buyer B d.o.o. is a VAT taxpayer and has the right to deduct input tax, and the company A d.o.o. is liable for the fee charged. Company A d.o.o. and B d.o.o. enter into an Agreement on the purchase and sale of the real estate in question on the 1st of August 2018. Company A d.o.o. issues an invoice to B d.o.o. in the total amount of HRK 5.000.000,00, of which the tax base is HRK 4.000.000,00 and the calculated VAT is HRK 1.000.000,00 on the 1st of August 2018.

Taxpayer B d.o.o., upon receipt of the invoice, makes a record of it in the business books, and submits a tax return for the accounting period of August 2018. He also exercises the right to deduct input tax in the amount of HRK 1.000.000,00. At the same time, for the same tax period, the invoicing period of the company A d.o.o. does not show a VAT liability because according to the business books the payment of the real estate in question has not been made.

Tax inspection was conducted at company A d.o.o. with the following findings:

- Company A d.o.o. and B d.o.o. entered into an Agreement regarding the purchase and sale of real estate, where company A d.o.o. sells the real estate to the company B d.o.o., and upon the payment of the total price, the company B d.o.o. will be able to register in the land register as the owner of the real estate. The payment deadline is not specified in the contract.
- The Agreement for company A d.o.o. and B d.o.o. is signed by the same natural person, as the responsible person for both companies is one and the same.
- Company A d.o.o. issues an invoice to B d.o.o. showing the calculated VAT based on HRK 4.000.000,00 in the amount of HRK 1.000.000,00.
- Company B d.o.o. exercises its right to deduct input tax on the submitted tax return and submits a request for its refund.
- Company A d.o.o., in its value added tax return form does not state the obligation per the issued invoice, stating that the real estate has not been paid and that it has no obligation to state VAT.
- In the process of tax inspection and collection of all facts relevant to taxation, the tax authority from the competent land registry department collects documentation according to which the company B d.o.o. based on the statement of the company A d.o.o. regarding payment, made a registration as the property owner.

- The companies have not registered the payment in their business books.
- Companies A d.o.o. and B d.o.o. are related in terms of the provisions of the General Tax Act.
- Company A d.o.o. has abused the system.
- To the company A d.o.o. a tax liability has been determined in the amount of the calculated VAT, which it did not declare or register.
- Against the company A d.o.o. and the responsible person in the same company an appropriate criminal complaint was filed.

5.2 Example of allowed tax planning

Natural person C owns a building plot on which he would like to build a hotel and engage in a tourism activity. The land was acquired in 2016 at a price of HRK 5 million and today it is worth HRK 7 million, and the person has about 50% of the funds needed for construction. Person C can structure his business in several ways and choose the most favourable ones from the aspect of tax burden as well as other goals:

1)

- Person C builds by himself on his own land
- He registers in the register of taxpayers; he is also an income taxpayer and is obliged to keep business books.
- After the completion of the building, he registers it into his business property.
- He is not registered as a VAT payer, so his construction is 25% more expensive because he is not entitled to deduct input tax.
- He is burdened with income tax, related contributions, monthly advances.
- If his receipts are higher than HRK 300.000,00, he enters the system of VAT payers. He will then have to calculate VAT, but he will also be able to deduct input tax at the rate of 25% and charge at the rate of 13% - positive effect.

2)

- Person C builds on his own land
- He registers as a VAT payer and is a taxpayer of income tax from self-employment, he can deduct input tax during construction.
- He can choose option of taxing a natural person with corporate income tax, tax rate 10% up to HRK 7.5 million of income.

3)

- Person C establishes a limited liability company.
- Registers as a VAT payer.
- Person C sells his land to the company, the company pays real estate transfer tax, real estate in the company's assets, depreciation expense.
- Construction with VAT but with the possibility of deducting input tax
- Deliveries are taxable at the 13% rate, and input VAT at the 25% rate.

4)

- Person C enters his land in the company's capital: the cost of the assessment but no real estate transfer tax.
- Profitability: in the ratio of investment costs with real estate transfer tax.
- No outflow of money to buy real estate.
- The rest is the same as previous option.

An overview of several possible options for starting a business in a specific situation is given. Among the offered or new options, the taxpayer should calculate which of the options is the most favourable or the most cost-effective.

6. Conclusion

Large fiscal and parafiscal levies make it difficult for Croatian entrepreneurs to compete on the market. Some entrepreneurs resort to activities that do not comply with legal provisions and enter the area of tax evasion for which they are often prosecuted. The conducted research confirmed the thesis that tax planning and optimization of value added tax enable entrepreneurs legal tax savings, whereby such funds can usefully be used in their business.

It should also be pointed out that planning implies a good knowledge of tax regulations to achieve optimization in taxation with the given funds and the application of appropriate strategies. To protect and secure its tax revenues, the state conducts detailed controls and inspections of taxpayers' operations, most often in value added tax. Therefore, tax planning pays off, but must be based on research and knowledge of legislation, reliefs, exemptions as well as appropriate methods, techniques, and strategies to reduce tax liability but within the legal framework.

In general, tax planning should achieve a reduction in the tax burden of multinational companies in which regulators of international tax law play a significant role, but also a comparison of the tax planning process, all with the aim of tax avoidance and tax evasion. Also, tax planning and tax avoidance require complete and up-to-date knowledge of tax laws.

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THE INFLUENCE OF LIQUIDITY ON FINANCIAL LEVERAGE

Petra Jakaša

University Department of Professional Studies, Split, Croatia
pjakasa@oss.unist.hr

Abstract. The aim of this paper is to investigate the influence of liquidity on financial leverage. Liquidity is the ability to cover short term debt with current assets, or specific parts of current assets. In this paper liquidity is measured with ratios generally used as a tool of financial analysis to determine companies' state of liquidity (current ratio, cash ratio, quick ratio). In the scope of this research those ratios are used as independent variables and the author analysed their influence on financial leverage. Financing sources include own capital and total debt. The use of debt as a financing source presents financial leverage. In this paper it is measured with leverage ratio generally used as a financial analysis tool. In the scope of this research short term debt ratio is dependent variables given the fact that it is expected that this ratio will be most affected by the state of liquidity. Survey included sample of 72 mid-size companies in Croatia which have assets between 30 mil HRK and 60 mil HRK and total revenues between 60 mil HRK and 300 mil HRK. Trough analysis of existing researches and author's own practical experience it is expected that companies with higher liquidity will have lower short term financial leverage. This thesis was tested with statistical methods using multiple linear regression. The statistical model proved to be statistically significant and negative correlation between liquidity and financial leverage was established, thus confirming stated hypothesis.

Key words: *liquidity, financial leverage, short term debt ratio, liquidity ratio*

1. Introduction

Most common definition of liquidity is that it is the ability to transform short term assets in cash sufficient to cover short term liabilities. Short term assets are assets that are expected to be converted into cash within one year, while short term liabilities are liabilities that will become due within one year (Žager, Vašiček, Žager, 2001).

For the purpose of this paper liquidity is measured with commonly used liquidity ratios which include current ratio, quick ratio and cash ratio (Žager et.al., 2008). Those ratios are used as independent variables in empirical part of the paper.

According to Žager, Vašiček, Žager (2001) sources of finances in the company include own sources and borrowed sources. Own sources include capital, retained earnings, reserves and other positions of balance sheet position equity. Borrowed sources of financing include long term and short term liabilities.

Financial leverage is commonly estimated with leverage ratios and for the purpose of this paper focus is placed on short term debt ratio due to the fact that it is expected that state of liquidity will have larger impact on those liabilities than on all other leverage ratios. Short term debt ratio is thus used as dependent variable in empirical part of the paper.

Based on literature and existing research review, as well as on the practical knowledge of the author it is expected that that negative relation between liquidity and financial leverage will be confirmed using statistic methodology.

2. Existing research and literature review

Ozkan (2001) researched capital structure determinants by analysing sample of 390 companies through time period of 5 years. He concluded that liquidity is negatively related to the level of financial leverage. In his research he used current ratio as measure of liquidity and debt ratio, long term debt ratio and short term ratio as measures of capital structure.

Research of capital structure determinants was also done by Malinić, Denčić-Mihajlov and Ljubenić (2013) on the sample of companies in Serbia. They concluded that leverage, measured both with total debt ratio and short term debt ratio, decreases under influence of liquidity, profitability, materiality and cash gap, while it increases under influence of growth prospects. In their research liquidity is also measured with current ratio.

More extensive research in this area was done by Mateev, Poutziouris and Ivanov (2013). Their research was based on large sample of 5.000 SME companies in Central and Eastern Europe for the time period between 2001 and 2005. They presented 5 hypothesis, among which the one relevant for this paper is that long term financial leverage is negatively correlated with liquidity, while short term financial leverage is positively correlated with liquidity. Their research rejected stated hypothesis and instead it showed that companies with higher liquidity rely more on long term debt, while companies with lower liquidity have higher portion of short term debt. In this research measures of financial leverage are long term debt ratio and short term debt ratio, while liquidity measure is current ratio.

Gill and Mathur (2011) analysed factors that influence liquidity in the Canadian companies. Sample for this research was formed from publicly available financial statements and it included 164 companies in the time period between 2008 and 2010. Among other conclusions from this research, they found that there is statistically significant negative correlation between financial leverage and liquidity. As measures of liquidity they used cash and marketable securities as portion of net assets, logarithm of liquidity (cash and marketable securities), logarithm of net assets, ratio of short term claims (accounts receivables) minus short term debt (account payables) divided by net assets and short term claims divided by net assets. As measures of financial leverage they used total debt ratio and short term debt ratio.

Paramita, Suhardjo and Asri (2021) analysed the influence of liquidity toward capital structure. Sample included manufacturing companies that have been listed on the Indonesia Stock Exchange. Using multiple linear regression this study indicate that liquidity has a negative influence toward capital structure or leverage in particular. Limitations of this study is that looks only at the debt to equity ratio as proxy leverage. This study researched large and small companies separately. Study showed that large companies tend to have a lower level of liquidity than small companies, making large companies need to find additional external funds.

Burksaitiene and Draugele (2018) researched capital structure impact on liquidity management. Research was done through analysis of companies that are listed on Nasdaq Baltic Stock Market. The sample is really small and it included 10 non-financial companies. Sample consists of 5 companies that are listed on Baltic Main list and 5 companies that are listed on Baltic secondary list. Research had different direction than

previously presented ones, analysing impact of capital structure on liquidity. Nevertheless, significant and negative correlation between leverage and liquidity was confirmed.

As for relevant Croatian researches, Šarlija and Harc (2012) researched the impact of liquidity on capital structure. The research included 1058 Croatian companies. Pearson correlation coefficient was applied to the test on the relationship between liquidity ratios and debt ratios, the share of retained earnings to capital and liquidity ratios and the relationship between the structure of current assets and leverage. This extensive study showed that there are statistically significant correlations between liquidity ratios and leverage ratios. Also, there are statistically significant correlations between leverage ratios and the structure of current assets. The relationship between liquidity ratios and the short-term leverage is stronger than between liquidity ratios and the long-term leverage. Authors conclude that the more liquid assets firms have, the less they are leveraged. Long-term leveraged firms are more liquid. Increasing inventory levels leads to an increase in leverage. Furthermore, increasing the cash in current assets leads to a reduction in the short-term and the long-term leverage.

3. Selection of variables

Following existing research analysis and practical experience, author selected measures of liquidity and financial leverage. For the purpose of this paper chosen measures of liquidity and financial leverage are calculated based on Žager et.al. (2017, 2018).

Selected measures of liquidity are: current ratio, quick ratio and cash ratio. These liquidity ratios are used as independent variables in following empirical research using statistical methods.

Selected measure of financial leverage is short term debt ratio and this is dependent variable in the following empirical research.

Table 1 Description of selected variables

Variable	Name	Calculation	Description
Independent variables	CURRENT RATIO	short term assets / short term liabilities	Current ratio - measures liquidity. Shows companies' ability to settle short term liabilities from its short term assets
	QUICK RATIO	(short term assets-inventories) / short term liabilities	Quick ratio - measures liquidity. Shows companies' ability to settle short term liabilities from highly liquid assets
	CASH RATIO	cash / short term liabilities	Cash ratio - measures liquidity. Shows companies' ability to settle short term liabilities from available cash
Dependent variable	SHORT TERM DEBT RATIO	short term liabilities / total assets	Short term debt ratio - measures financial leverage. Shows portion of total assets that is financed with short term debt.

Source: author

4. Methodology and results of empirical research

Data for this research was gathered from secondary source, more specifically from FINA financial statements' database. Database includes publicly available financial statements of Croatian companies which are available for secondary use.

Sample was selected to include only financial data for the year 2020 and companies which meet following criteria: total assets from 30 to 60 mil HRK and total revenues from 60 to 300 mil HRK. Based on those criteria sample of 72 companies was created. Applied statistical methods and interpretations are referenced from Pivac (2010), Crawson (2015, 2018) and Lambert (2013).

In empirical part of this paper influence of liquidity on financial leverage was analysed using multiple linear regression.

Regression was done using weighted least squares method (using standard deviation) in order to eliminate problem of heteroscedasticity, which is one of necessary assumptions in linear regression.

Stepwise method was used for selection of variables to be included in the model. Using this method all three independent variables entered the model.

Table 2 Variables entered in the model (stepwise method)

Variables Entered/Removed^{a,b}

Model	Variables Entered	Variables Removed	Method
1	CURRENT RATIO		Stepwise (Criteria: Probability-of- F-to-enter <= , 050, Probability-of- F-to-remove >= ,100).
2	QUICK RATIO		Stepwise (Criteria: Probability-of- F-to-enter <= , 050, Probability-of- F-to-remove >= ,100).
3	CASH RATIO		Stepwise (Criteria: Probability-of- F-to-enter <= , 050, Probability-of- F-to-remove >= ,100).

a. Dependent Variable: SHORT TERM DR

b. Weighted Least Squares Regression - Weighted
by weight

Following table is used to assess relevance of regression model.

Table 3 Model summary

Model Summary^{d,e}

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Durbin-Watson
1	,821 ^a	,674	,670	1,292353777	
2	,839 ^b	,704	,695	1,241368657	
3	,853 ^c	,727	,715	1,199795650	2,078

- a. Predictors: (Constant), CURRENT RATIO
 b. Predictors: (Constant), CURRENT RATIO, QUICK RATIO
 c. Predictors: (Constant), CURRENT RATIO, QUICK RATIO, CASH RATIO
 d. Dependent Variable: SHORT TERM DR
 e. Weighted Least Squares Regression - Weighted by weight

Table shows that calculated correlation coefficient is $R = 0,853$ and it implies moderately strong linear correlation between independent variables entered in the model ("current ratio", "quick ratio" and "cash ratio") and dependent variable "short term debt ratio".

Determination coefficient (R Square) is $r^2 = 0,727$ and it shows that regression model explains 72,7% of sum of squares of total estimated variation of dependent variables from its mean. Determination coefficient is satisfactory, but it also shows that variation in the dependent variable is influenced by other variables that are not included in the model which is expected.

ANOVA table is used to determine whether the model as a whole is statistically significant.

Table 4 ANOVA of the regression model

ANOVA^{a,b}

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	241,967	1	241,967	144,875	,000 ^c
	Residual	116,912	70	1,670		
	Total	358,880	71			
2	Regression	252,551	2	126,276	81,944	,000 ^d
	Residual	106,329	69	1,541		
	Total	358,880	71			
3	Regression	260,993	3	86,998	60,436	,000 ^e
	Residual	97,887	68	1,440		
	Total	358,880	71			

- a. Dependent Variable: SHORT TERM DR
 b. Weighted Least Squares Regression - Weighted by weight
 c. Predictors: (Constant), CURRENT RATIO
 d. Predictors: (Constant), CURRENT RATIO, QUICK RATIO
 e. Predictors: (Constant), CURRENT RATIO, QUICK RATIO, CASH RATIO

As can be seen in ANOVA table significance is under 5% which means that regression model is statistically significant.

Next table will be used to assess regression coefficients.

Table 5 Regression coefficients

Coefficients^{a,b}

Model	Unstandardized Coefficients		Standardized Coefficients	t	Sig.	95,0% Confidence Interval for B		Collinearity Statistics		
	B	Std. Error	Beta			Lower Bound	Upper Bound	Tolerance	VIF	
1	(Constant)	,675	,037		18,318	,000	,602	,749		
	CURRENT RATIO	-,113	,009	-,821	-12,036	,000	-,132	-,095	1,000	1,000
2	(Constant)	,680	,035		19,181	,000	,609	,751		
	CURRENT RATIO	-,137	,013	-,991	-10,753	,000	-,162	-,112	,506	1,978
	QUICK RATIO	,041	,015	,241	2,621	,011	,010	,071	,506	1,978
3	(Constant)	,648	,037		17,687	,000	,575	,721		
	CURRENT RATIO	-,108	,017	-,780	-6,262	,000	-,142	-,073	,259	3,868
	QUICK RATIO	,058	,017	,344	3,488	,001	,025	,091	,413	2,422
	CASH RATIO	-,146	,060	-,330	-2,422	,018	-,267	-,026	,216	4,624

a. Dependent Variable: SHORT TERM DR

b. Weighted Least Squares Regression - Weighted by weight

Coefficient β_0 (constant) is 0,648 and presents expected value of dependent variable „short term debt ratio“ in case all independent variables are 0. Significance level of this coefficient is under 5%, so this coefficient is statistically significant.

Coefficient with independent variable “current ratio” β_1 is -0,108 with significance under 5% indicating that it is also statistically significant. It shows that if variable „current ratio“ increases for 1 unit, dependent variable „short term debt ratio“ will decrease for 0,108 under presumption that other variables are not changed.

Coefficient with independent variable “quick ratio” β_2 is 0,058 with significance under 5% indicating that it is also statistically significant. It shows that if variable „quick ratio“ increases for 1 unit, dependent variable „short term debt ratio“ will increase for 0,058 under presumption that other variables are not changed.

Coefficient with independent variable “cash ratio” β_3 is -0,146 with significance under 5% indicating that it is also statistically significant. It shows that if variable „cash ratio“ increases for 1 unit, dependent variable „short term debt ratio“ will decrease for 0,146 under presumption that other variables are not changed.

For multiple regression model to be valid it is necessary that several basic assumptions are met. Tests and conclusions regarding multicollinearity of regressor variables, autocorrelation of residuals, heteroscedasticity of residual variance and normality of distribution is shown further on.

✓ **Multicollinearity of regressor variables**

One of the basic assumptions for multiple regression model is independence of regressor variables. If it is not fulfilled it is said that there is a multicollinearity problem in the model.

This is tested through Variance Inflation Factor (VIF) and Tolerance (TOL). If VIF is < 5 and TOL $> 20\%$ it can be concluded that there is no multicollinearity among regressor variables.

Table 5 shows that VIF is lower than 5 and TOL is higher than 20% for all parameters, therefore it is confirmed that there is no multicollinearity among regressor variables.

✓ Autocorrelation of residuals

Autocorrelation of residuals is tested with Durbin-Watson test.

With significance level of 5%, sample size $n=72$ and number of regression variables $k=3$ DW should be between 1,703 and 2,475. Calculated empirical value is presented in table 3 and it is $DW=2,078$, therefore it can be concluded that there is no autocorrelation of residuals.

✓ Distribution of residuals

Following graph shows histogram and P-P plot of residuals.

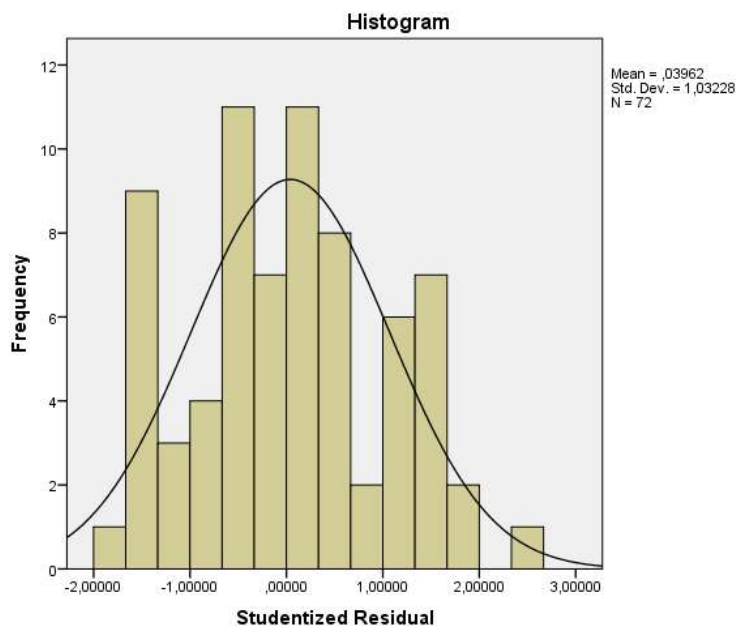


Figure 1 Histogram of residuals distribution

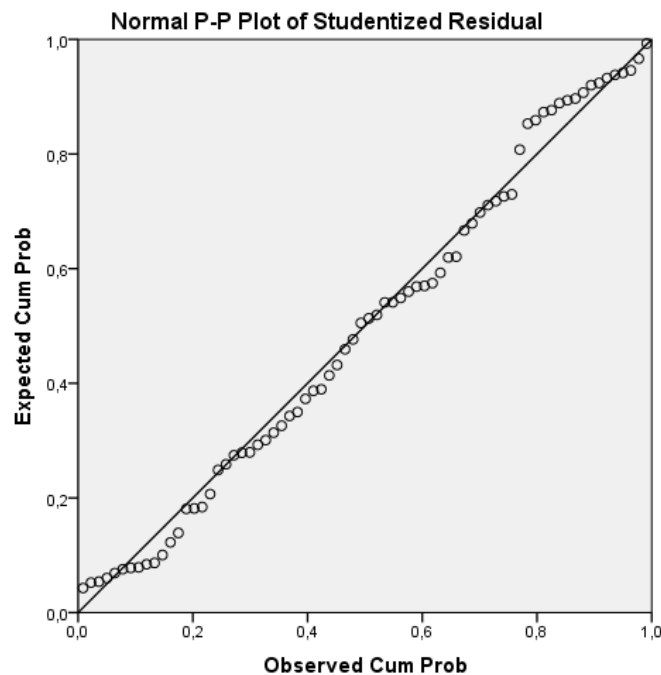


Figure 2 P-P plot of residuals

Presented histogram and P-P plot show that residuals have normal distribution.

✓ **Heteroscedasticity of residual variance**

Heteroscedasticity of residual variance was tested with Spearman's rank correlation coefficient.

Table 6 Spearman's rank correlation coefficient

Correlations						
			CURRENT RATIO	QUICK RATIO	CASH RATIO	absstudres
Spearman's rho	CURRENT RATIO	Correlation Coefficient	1,000	,810**	,583**	-,203
		Sig. (2-tailed)	.	,000	,000	,087
		N	72	72	72	72
	QUICK RATIO	Correlation Coefficient	,810**	1,000	,647**	-,076
		Sig. (2-tailed)	,000	.	,000	,523
		N	72	72	72	72
	CASH RATIO	Correlation Coefficient	,583**	,647**	1,000	-,047
		Sig. (2-tailed)	,000	,000	.	,697
		N	72	72	72	72
	absstudres	Correlation Coefficient	-,203	-,076	-,047	1,000
		Sig. (2-tailed)	,087	,523	,697	.
		N	72	72	72	72

** . Correlation is significant at the 0.01 level (2-tailed).

As presented in the table above empirical significance of correlation coefficients are $\alpha_1^* = 0,087$, $\alpha_2^* = 0,523$ and $\alpha_3^* = 0,697$. Since significance level for all variables are

above 5% it can be concluded that there is no heteroscedasticity of residual variance.

5. Conclusion

The purpose of this paper was to research the influence of liquidity on financial leverage.

Data was gathered from secondary source of publicly available FINA database of financial statements of Croatian mid-size companies. Sample comprised of 72 mid-size companies and included financial statements for the year 2020.

Multiple linear regression was used to create model with three independent variables measuring liquidity ("current ratio", „quick ratio“ and „cash ratio“) and dependent variable "short term debt ratio" measuring financial leverage. Selection of variables for the model was done with Stepwise method.

Statistical analysis showed that the model as a whole is statistically significant and that independent variables „current ratio“ and „cash ratio“ have significant and negative correlation with dependent variable which is in line with initial hypothesis. However, contrary to initial hypothesis, analysis also showed that independent variable „quick ratio“ has significant and positive correlation with dependent variable.

This paper adds to the existing research regarding determinants of financial leverage, but it is limited to short term debt ratio as proxy leverage. In the future research conclusions may be furthered and improved by increasing sample size and number of observations trough years, as well as by introducing more variables in the observation.

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THE IMPACT OF THE BUSINESS MODEL ON THE STABILITY OF THE BANKS. THE CASE OF THE REPUBLIC OF NORTH MACEDONIA

Ljube Jolevski, M.Sc.

PhD candidate in the study program Economic science, “Ss. Cyril and Methodius”
University in Skopje, Faculty of Economics – Skopje, North Macedonia
ljubejol@yahoo.com

Snezana Dicevska, Ph.D.

Full professor, “University St. Kliment Ohridski Bitola”, Faculty of Tourism and
Hospitality – Ohrid, North Macedonia
snezana.dicevska@uklo.edu.mk.

Abstract. The business models of banks differ according to the key banking activities, financing strategies and risks they take. Successful harmonization of available opportunities and the business model of the bank is the basis for healthy and sustainable profitability. The characteristics of the business model are correlated with the risks to which banks are exposed. Many factors related to the structure of the business model can affect the overall risk profile of banks and their survival. The analysis of the business model should also serve to identify the key weaknesses in the bank's operations, which could have a material impact on its sustainability or could lead to non-fulfillment of the bank's business goals in the future. Macedonian banks apply traditional banking with a dominant activity of lending to households and the corporate sector. In fact, the analysis shows that by applying certain criteria the two types of business models can be identified, ie banks that are more oriented towards lending to households and banks that are more oriented towards lending to the corporate sector. The aim of this paper is to determine whether the choice of business model impact on the stability of banks measured by the Z-score. The Z-score is an indicator based on data from the balance sheet that provides an estimate of the bank's distance to default. Therefore, the Z-score is used as an indicator of insolvency risk. It will be calculated for each business model of banks and then with the comparison method will determine which business model is more stable and resistant to default. The results of the research will indicate to the creators of the business policies of the banks in defining the choice of business activities, i.e. the business model of dealing.

Key words: banks, business models, Macedonian banks, Z-score, stability JEL: G21, G33

1. Introduction

The efforts for economic development of each country are in vain without a developed banking sector as a major intermediary for the mobilization of free financial resources and their effective direction of investments.

Starting from the fundamental attitude towards risks, banks define their business model in order to effectively manage risks and achieve overall positive results. Determining the business lines and activities, as well as the business goals is a starting point, and the competence and success in managing the bank can be a factor that will generate a comparative advantage.

Depending on the nature, size and complexity of the financial activities they perform, the banks determine how and with which activities they will achieve the planned business and financial goals, i.e. they choose the business model. Business models differ according to the key banking activities, financing strategies and risks they take.

Successful harmonization of available opportunities and the business model of the bank is the basis for healthy and sustainable profitability. Therefore, the business model is of essential interest to all stakeholders, and the relevance of in-depth analysis of the business models of banks is understandable, which are in line with the emphasized need for profitable and reliable operation of the bank. Their indisputable role and significance for the overall results, but especially stability of the banks multiplies the topicality of the research for analysis of the business models of the banks.

The aim of this paper is to identify the two different business models in Macedonian banks and analyze their stability. The paper is consisting of several parts. First, it gives a brief survey of the main findings regarding the banks' business models. Second, it reviews a short analysis of the Macedonian banking system. Third, it explains the used research methodology and then comment the results. Finally, it offers some conclusions.

2. Literature review

There are numerous researches related to certain aspects of banking. However, the literature focused on the study of banks' business models does not have a long history. The number of researches related to systematic quantitative approaches for identifying and analyzing the business models of banks is relatively small.

Originally, the term business model or "strategic group" was mentioned by Hunt in 1978 (Roengpitya et al., 2017) and was used mainly in the field of management studies. The concept of business model was widely accepted and elaborated in the literature on management and business, and little in the field of economics and finance. In 2018 and 2019, the number of scientific papers in this field has rapidly increased. Thereby, the trend of development of information systems, new sales channels (e-banking, mobile banking, etc.) and internal rules in business process management become an important part of the analysis of business models of banks. In fact, technology, the fintech industry, e-sales, innovation and competition are becoming important parts of banks' business models and authors increasing interest in this field for their research.

Casadesus-Masanell and Ricart (2010) believe that the business model is a direct result of the realization of the bank's strategy. Goncharenko (2020) concludes that the key to leadership and innovation in banking is the balance between the triangle of profitability - risk - stability, on the one hand and information technology on the other. The following are important papers that begin to analyze business models in individual banks, i.e. their identification and efficiency assessment: Ayadi et al (2011, 2014, 2016, 2019), Ayadi and de Groen (2014), Farne and Vouldis (2017), Margaerts and Vennet (2016), Brighi and Venturelli (2016), Bonaccorsi di Patti and Palazzo (2018), Roengpitya et al (2017), Halaj and Zochowski, ECB Working Paper 2070 (2017).

Ayadi et al (2011) are pioneers in business model analysis. They are making an initial attempt to identify the business models of 26 European banking institutions and assess

their effectiveness for the period between 2006 and 2009. Based on the use of balance sheet data, three business models have been identified: retail banking, investment banks and wholesale business model. The results showed that the retail banking model performed better in the crisis period in terms of performance compared to other identified business models, which registered much riskier behavior before and during the years of the financial crisis. The analysis of business models also showed that the regulatory requirements of the Basel Standards are not appropriate for all business banking models.

Mergaerts and Vennet (2016) investigate the impact of banks' business models on their long-term performance, using data from 505 banks in 30 European countries between 1998 and 2013. The research concludes that business models with retail activities are characterized by higher profitability and long-term stability. These conclusions are in favor of the fact that in the post-crisis period, banks refocused on traditional activities. Thus, banks with diversified business models, i.e. banks with lower share of loans are profitable, but they are less stable.

Roengpitya et al. (2017) applying a methodology based on a panel of 178 banks in 34 countries for the period 2005-2015 conclude that in the analyzed period, more specifically after the crisis, there is a trend of changing business models of banks with greater focus on increasing retail financing banking. At the same time, banks that were oriented towards retail activities noticed an increase in their return on capital by 2.5 percentage points on average compared to those banks that did not change this business model. In contrast, the performance of banks that reoriented to the corporate model deteriorated by an average of 5 percentage points. Hence, the authors conclude that the transition to the type of business model of banks affects the performance of banks.

Halaj and Zochowski (2017) surveyed 147 European banks, identifying four different business models: traditionally commercial, complex commercial, funded by retail, and holding investment banks. Their results show that the investment model is the riskiest, and that traditional banks are less risky than other models.

Grossman and Scholz (2019) conclude that retail banks carry significantly lower financing costs than wholesale and commercial banks.

Kohler (2015) analyzes the impact of business models on the stability of the banking sector in 15 EU countries for the period between 2002 and 2011. It identifies the business models of banks according to the share of non-interest income in total operating income and the share of non-deposit financing in total liabilities. The author concludes that retail-oriented banks will be more stable and more profitable if they increase the share of non-interest income, ie if they generate income from non-traditional activities, because it makes them less dependent on interest income and improves income diversification and risk. At the same time, they will be less stable if they increase funding with non-deposit sources.

Hryckiewicz and Kozłowski (2016) analyze the heterogeneity between different business strategies applied by systemically important banks in 65 countries from 2000 to 2012. The authors conclude that during the mortgage crisis, the investment model of banks indicates the lowest individual risk and the highest systemic risk at the same time. Therefore, they believe that the structure of funding sources is responsible for the systemic effect of the mortgage crisis.

Banks are not expected to often change their business models. However, they can engage in a process of adapting their business models to respond to market developments, competition and the race for higher profits, as well as status changes with competitors (mergers and acquisitions); to respond to decisions and structural reforms undertaken by the regulator or the state; to adapt to technological transformations and financial innovations (e.g. fintech, artificial intelligence, blockchain and virtual currencies); to adapt to the macroeconomic cycle (e.g. significant changes in the real estate market); for other reasons (e.g. political events, such as the UK's exit from the European Union).

Ayadi et al (2019) based on the analysis of data from 2005 to 2016 developed a matrix for the transition of business models for banks in Europe, based on which they showed that there are differences in the behavior of business models. Namely, the focused retail business model showed the greatest persistence, i.e. 90% of the banks from this business model did not make its change in the analyzed period. Other business models, such as diversified retail banks, wholesale and investment banks, remained in the same model in a slightly lower percentage (89%, 87%, 80% and 85% respectively).

3. Characteristics of the banking sector of R. N. Macedonia

As of December 31, 2021, the Macedonian banking sector consists of 13 banks and two savings houses. The total assets amount to EUR 9.5 billion. With a share of 73.4%, deposits have the largest share in creating the financial potential of banks. In Macedonian conditions, a traditional model of banking has been established, i.e. collecting free cash from households and the corporate sector and directing them to approve loans to entities where there is a cash deficit. Modern banking instruments as financial derivatives have not yet been developed. Loans participate with 60.1% in the total assets, whereby the share of loans to non-financial companies is slightly higher (36.2%), as opposed to household loans (32.1%).

Foreign capital participates with 75% in the total share capital. Hence, the banking sector is influenced by both economic and non-economic factors arising from their parent entities and their countries of origin. The analysis of the structure of the banking system by dominant shareholder points Greece, Slovenia and Turkey as owners with dominant share in the total capital of the Macedonian banking system. One of the characteristics of the Macedonian banking sector is the high concentration, despite the fact that there is a tendency to reduce it. The concentration measured according to the Herfindahl index for almost all categories for which it has been calculated over the years, shows a relatively acceptable level. The largest five banks account for 76.5% of the total assets, and the difference between the largest and the smallest share is still significant (0.5% for the smallest bank and 22.7% for the largest bank). Almost half of the banks have an individual share of up to 3%.

The share of the largest five banks in the creation of the deposit potential is dominant with 82.3% of the household deposits and 79.4% of the deposits of the non-financial entities. The situation is similar with loans: the largest five banks participate in household loans with 77.9%, and in loans to nonfinancial entities with 76.5%. Consequently, they are the drivers of the overall activities and changes in the banking market.

In terms of risks to which the banking sector is exposed, credit risk is the most significant inherent risk in banks' balance sheets, given the dominance of the traditional banking model. NPL ratio is 3.2%. The banking sector is profitable with ROAA 1.5% and ROAE 12.9%. Also, the banking sector is stable with adequacy ratio of 17.3%. It contributes as a significant buffer for financial distortions.

4. Methodology for identifying business models and assessing their stability

The literature generally knows two approaches to identifying business models of banks:

- Judgment expert assessment based on descriptive statistics on one or more positions of the balance sheet and income statement. Bonaccorsi di Patti, Felici, Signoretti (2016) divide banks according to the share of loans in assets (whether below or above 50%), the size of assets, the share of non-resident exposure, and
- application of cluster analysis based on one or more characteristics (usually the structure of assets and / or liabilities and income).

Clustering is a simple statistical technique used to determine a set of observations (i.e. a particular bank in a given year) into groups (i.e. business models) that are generally different, i.e. do not overlap. By definition, excitations assigned to the same cluster share a high degree of similarity within the cluster.

One of the most widely used measures is the calculation of the Calinski-Harabaz (CH) index introduced in 1974 and is also known as the Variance ratio criterion. The CH index is a measure used to determine similarities of one's own cluster (cohesion) compared to other clusters (division).

The calculation of the Calinski-Harabaz (CH) index for C-number of clusters from the database $D = [d_1, d_2, d_3, \dots, d_N]$ is defined as follows:

$$CH = \left[\frac{\sum_{k=1}^K n_k \|c_k - c\|^2}{K - 1} \right] / \frac{\sum_{k=1}^K \sum_{i=1}^{n_k} \|d_i - c_k\|^2}{N - K}$$

where:

- n_k and c_k are the number of points and centroid of the k^{th} cluster respectively
- c is a global centroid, and
- N is the total number of data points.

Higher value of the CH index means that the clusters are dense and well separated, although there is no "acceptable" cut-off value. It is necessary to choose the solution that gives the highest value to the CH indices. The advantage of using this index is that the result is fast to calculate, and the disadvantage is that this index is generally higher for convex clusters than other cluster concepts, such as the results obtained through the Davies – Bouldin Index.

The second step is to analyze the degree of stability of banks. Banks are required to operate with sufficient capital to cover the risk taken, to have sufficient liquid assets and to be resistant to extreme shock scenarios.

The Z-score (Z-score - distance to default) was used in the research. It is an indicator based on data from the balance sheet that provides an estimate of the bank's distance to default. In the literature (Stiroh, 2004a, b; Stiroh and Rumble, 2006; Demircuc-Kunt and Huisinga, 2010; Ayidi, 2016, 2019) the Z-index is used to measure the risks of identified business models, defined as the number of standard deviations from the rate of return on the bank's assets to make the bank insolvent. Therefore, the Z-index is used as an indicator of insolvency risk.

In essence, this risk measure uses historical income and return volatility, as well as current levels of capital, to construct a level of (one-time) shock above the historical average that would lead to default. The higher the value of the Z-index, the farther the bank is from defaulting, and the less likely it is to default.

The Z-index (also called the standard score) is calculated as follows:

$$Z - score_{it} = \frac{\frac{Total\ Equity_{it}}{Total\ Asets_{it}} + E_{it}(ROA)}{\delta_{it}(ROA)} = \frac{CAP_{it} + E_{it}(ROA)}{\delta_{it}(ROA)}$$

where:

- ROA is the rate of return on average assets;
- Total Equity is the capital and reserves;
- Total Assets represents the assets;
- σ (ROA) is a standard deviation from the rate of return on average assets, calculated for the last three years.

It can be seen from the formula that this measure combines several performance indicators: Bank Profitability Index (ROA), Banking Risk Level Indicator [σ (ROA)] and Bank Stability and Solvency Measure (E. / A). Calculated in this way, the Z-index measures the "distance" of the bank from the complete exhaustion of its capital potential, expressed in the number of standard deviations from the rate of return on assets. Hence, it is a measure of the capacity of banks to absorb losses. Higher levels of this index indicate a lower level of risk and a higher level of bank stability. The Z-index is usually expressed in logarithmic form (natural logarithm of the previously given formula), but is easier to interpret and is more indicative when expressed in levels.

5. Results and discussion

The main business line of Macedonian banks is lending. This is determined through the dominant share of loans of the non-financial sector in the total assets, the dominant share of deposits in the sources of financing, but also through the net interest income which with a share of 64.6% are the most significant in the structure of total revenue. Households are traditionally the most important depositor in the Macedonian banking sector with a share of 68.2% in total deposits. They prevail in the total liabilities of all banks. The main carriers of interest income and gross loans are households and the corporate sector. Hence, the variables used to determine the clusters are: the percentage share of loans in assets, the percentage share of deposits in assets, the

percentage share of trading activities in assets, as well as the separation of household lending and corporate lending by calculating the indicators for the share of household loans in the total loans and the share of the loans of the corporate sector in the total loans.

By applying the Calinski-Harabaz index, i.e. Pseudo-F, it was confirmed that the division of Macedonian banks into two clusters is optimal, given that this test has the highest value for two clusters.

Table 1. Pseudo-F Index

Number of clusters	Pseudo-F
2	199,25
3	165,46
4	136,96

The factor analysis suggests that two important strategies for business activities have been identified, namely: banks that are more focused on corporate lending and banks that are more targeted at households. It is important to emphasize that all banks, ie both business models lend to both households and the corporate sector, but the difference is in which sector they are more focused, ie which sector dominates in the structure of their loan portfolio. The assets of the banks identified with a business model more focused on lending to the corporate sector account for 54.6% of the total assets of the Macedonian banking sector, while the assets of banks identified with a business model predominantly focused on lending to households account for 45.4%. Given the migration of business models of individual banks in the analyzed period, as well as the different growth of individual banks, the dynamic analysis indicates that at the end of 2010 the assets of banks more focused on lending to the corporate sector accounted for 69.5% of total assets of Macedonian banks, as opposed to the second type of business model of banks predominantly focused on household lending, which created 30.4% of total assets.

If the banks more focused on lending to the corporate sector had a market share in the total assets of Macedonian banks of 66.2% in 2010, at the end of 2019 their market share decreased to 53.6%. Conversely, the market share of banks aimed at lending to households in assets increased from 33.8% in 2010 to 46.4% at the end of 2019.

Figures 1 and 2 show the stability of individual business models measured by the Z-index. It is calculated for each individual bank for the analyzed period, and then the average and median value of the index is calculated by the banks grouped in the two different business models, their sub-median value (first quarter) and supermedia value (third quarter). The median rating for the stability of the two business models is relatively close to the average value. The Z-index calculation for both business models shows that the stability is at a relatively high level. Thereby, banks aimed at lending to households have a longer distance to default (i.e. less exposed to default), while banks aimed at lending to the corporate sector are closer to default.

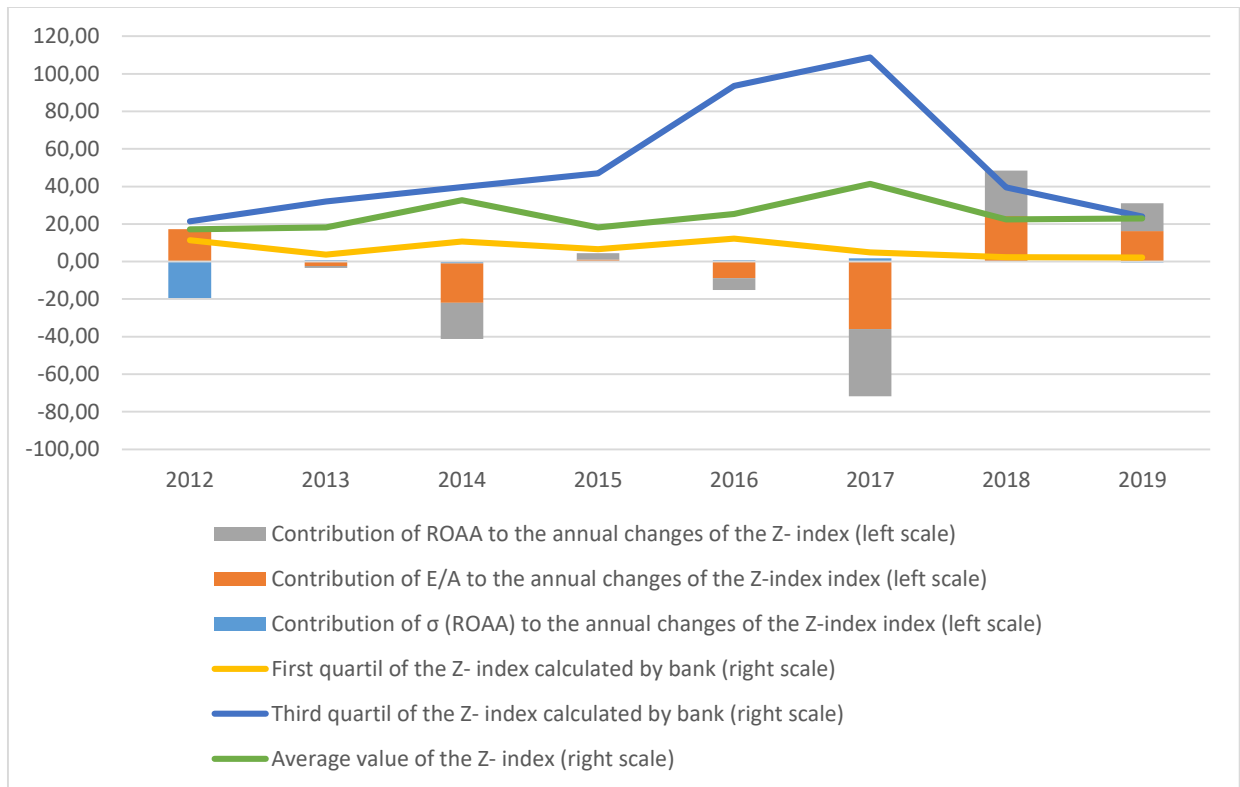


Figure 1. Z-index in levels for banks oriented more towards corporate lending

At the end of 2019, on average, a negative shock in the amount of at least 99.74 standard deviations from the rate of return on average assets is needed in order to completely deplete the capital potential of banks aimed at lending to households. Thereby, the average values of the index increased significantly during 2018 and 2019, mainly due to the results of one bank. The upward movement of the Z-index indicates a lower level of risk and a higher level of overall stability.

As for the banks, which are more focused on lending to the corporate sector, they need 33.6 standard deviations from the rate of return on average assets in order to fully deplete their capital potential. In this context, it should be noted that at the end of 2019, the value of the Z-index for one bank was 0.81, ie less than 2, which indicates the inevitability of declaring the bank bankrupt. Unfortunately, that really happened in the second half of 2020. Excluding the case of that bank, then the average value of the index for banks aimed at lending to the corporate sector increases to 46.5, which indicates relative stability in the operations of these banks.

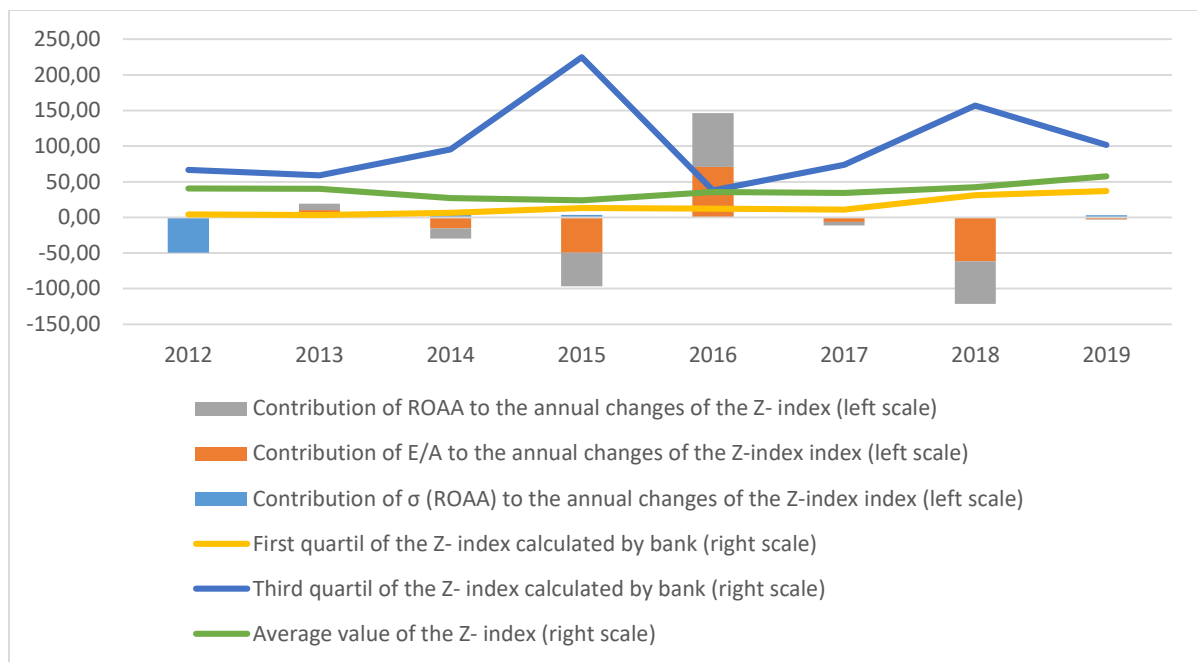


Figure 2. Z-index in levels for banks oriented more towards corporate lending

Summarizing the previous knowledge, it can be said that at the level of the banking sector, the stability of banks measured by the Z-index is relatively high. So, the banks more focused on household lending show better performance and lower level of risk.

6. Conclusion

Macedonian banks apply traditional banking. Despite all the innovations in the financial sector, credit risk is still one of the main risks in banking with a dominant impact on the operations of banks. Given the fact that credit risk exposure continues to be the leading source of income for banks, lending activities determine the business model of banks. This paper identifies two business models of Macedonian banks: banks more focused on household lending and banks more focused on the corporate sector. Risk analysis shows differences between different business models over the economic cycle. The analysis confirmed that banks that are more focused on household lending show a lower degree of risk and higher stability.

Only a healthy, reliable, stable and efficient banking sector that enjoys the trust of economic entities can provide adequate financial support to the corporate sector and households and be an effective intermediary of the resources of the national economy in order to intensify economic development.

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THE ROLE OF ACCOUNTING INFORMATION IN THE BUSINESS COMMUNICATION

Petar Pepur

*University department of professional studies, Split, Croatia
ppepur@oss.unist.hr*

Filip Klarić Kukuz

*University of, Split, Split, Croatia
fkkukuz@unist.hr*

Jelena Hrga

*University of, Split, Split, Croatia
jelena.hrga@unist.hr*

Abstract. Accounting and business communication are crucial factors for the successful business of all business entities. Accounting justifies its role with accounting information which are significant in business managing. Business managing requires an excellent business communication to ensure information flows which are crucial in the business decisions process. The business success and company existence are conditioned by the business communication system with which company manages by the internal business processes and develops relationships with the external environment. With internal business communication the companies seek to motivate employees to achieve the set business goals, until with external business communication the companies seek to set future business goals. In recent times accountants are often active members of the company management and as such they have to constantly interact and communicate with internal and external stakeholders, what imply that accountant should have effective communication skills. The role of accounting information in business management and also the role of business communications in business management are indisputable and significant, but the question arises if the accounting information have a significant role in business communication process, i.e. whether companies use accounting information in business communication. Therefore, this paper analyzes and present the role of accounting information in business communication process.

Key words: *accounting, accounting information, business communication*

1. Introduction

Currently business climates are unpredictable and turbulent. The company prosperity in unpredictable and turbulent conditions is possible only if the company develops business in accordance with the changes. In these conditions, it is necessary for company management to know internal and external situation, in order to adequately prepare for the new situation. Informing in such circumstances is crucial, because by having timely, accurate, reliable and objective information, the company ensures a quality business decision. A significant part of these information is obtained by accounting, which extracts and processes data from the resulting business events in order to obtain usable information for the business decisions. In this way, accounting, by creating business information is closely connected with the business management process and confirm his significant role in business managing. Accountant as active

members of business management have to interact and communicate with internal and external parties and on that way, they must be able to ensure adequate business information in both directions. Processing and transmitting information between different persons, departments and companies demand for accountant a very good communication skills which are crucial in ensuring business coordination and control. Accountants constantly communicate and interact with wide range of people, with high volume of financial information, so it is vital for companies to emphasize effective communication skills among their accountants. Also, recent literature suggests significant connection between communication and accounting especially in the importance of effective communication skills to success in the accounting profession. From the above we can point out that accounting information and business communications play significant role in the business management but we don't know if the accounting information have a significant role in business communication process. So, the paper objective is to find out whether companies use accounting information in the business communication.

2. Accounting information

Today's business environment is marked by dynamic and frequent changes, so the business prosperity is possible only if the company play in accordance with the changes. In such conditions, it is necessary to know the situation in the environment and also the situation within the company. Informing in such circumstances is crucial especially in the business managing. The importance of information derives from the following definition: Information represent a news which brings a new knowledge needed for future business activities. A significant part of necessary information is obtained by accounting, which processed data from the resulting business events in order to create usable information base for the future business managing. Starting from the fact that (Ramljak, 1999):

- accounting information is a highly valuable and generally accepted resource for business decision-making,
- the application of the chosen accounting procedure has real economic consequences,
- the accounting system is liable to changes in business conditions,

we can conclude that accounting is the fundamental regulator of a company with its environment in the order to overcome a business challenges which arises from the new business situation. Accounting evolved into significant management tool in business managing especially in turbulent business conditions when company needs timely, accurate, reliable and objective information which would help company to be in line with new circumstances. To be in line with new circumstances the company have to communicate with enviroment. Accounting is often called as language of busines, so to communicate with enviroment the company mostly use accounting information. Accountants are active members of the company management and as such they have to constantly ensure adequate accounting information for business managing. The above suggests that accounting information is highly valuable and significant resource of business communications.

3. Business communication

The beginnings of humanity are beginnings of communication from which we can point out the significance of communications. Communications are essential in each aspect of life. Communication as exchange of information is a core activity of each business entities which helps to involve company members in one direction for the benefit of a business. The function of communication is to ensure that every member of the organization knows what is expected. Good communication is critical in ensuring coordination and control of individuals, groups and departments (ACCA, 2022.), while the poor communication leads to ineffective control, poor coordination and inevitably management failure. (Kless, 2021) Prompt, clear, and effective communication is a vital component of any successful business model. Efficient communication is of particular importance in certain industries, such as accounting, which deals with high volumes of sensitive financial information, often in real-time. For this reason, it's crucial for all managers to emphasize strong accounting communication skills among their workforce. From previously mentioned we can conclude that no successfully business without adequate business communication. Adequate business communication also simplifies company operations and increase productivity and profitability. (Stowers & White, 1999) tried to find answer on question "what do the accounting and communication fields have in common?". Their study results show that communication skills are valued highly within professional accounting firms. Also, previous papers suggest the importance of effective communication skills to success in the accounting professions (Ingram & Frazier, 1980; Addams, 1981; Gingras, 1987; Henry & Razzouk, 1988; Novin, Pearson & Senge, 1990.). Accounting is no more back office profession, nowadays accountants must constantly interact with internal and external company entities. The importance of communication skills also recognized by Accounting Education Change Commission (Accounting Education Change Commission, 1990) which stated that to become successful professionals, accountants must possess communication skills, intellectual skills and interpersonal skills. The above indicates the importance and significance of business communication in the accounting profession, however, there are no papers that show the role of accounting information in business communication.

4. Methodology and data description

The aim of this paper was to explore the role of accounting information in business communication process. For explore it, we developed a survey to assess the role of accounting information in business communication. For data analysis we employed Likert scale survey which is one of the most reliable ways to measure opinions and attitudes of persons towards a particular thing. Also, Likert scale by different opinion degrees ensures a much clearer answer and better feedback. The questionnaire was sent to 80 different companies from Croatia, of which 48 were completed (a response rate of 60%). From collected data we found that the most represented groups of age are: 37,5% group from 36 to 45 years, 29% group from 26 to 35 years and 23% group from 46 to 55 years. Also, regarding working experience, the most represented groups are 41,6% respondents from 11 to 15 years of working experience, 22,9% respondents from 5 to 10 years of working experience and 20,8% respondents from 16 to 20 years of working experience. Regarding educational level, 41,6% represent respondents with professional study program (120 ECTS), 20,8% respondents with undergraduate

university study program (180 ECTS) and 18,7% respondents with graduate university study program (300 ECTS). Regarding the role in the company, 20,8% respondents represent a company owner, 41,7% respondents represent a company manager and 37,5% respondents represent a company employer. The first step of the research was to examine the level of accounting and financial knowledge. Respondents were asked by the three questions to provide a self-assessment of their accounting and finance knowledge, what are presented by Table 1.

Table 1 Accounting and finance knowledge

1=Very poor; 2=Poor; 3=Good; 4=Very good; 5=Excellent	1	2	3	4	5
I understand the accounting process of the organizations		2,1%	6,2%	75%	16,7%
I understand the contents of the financial statements			4,2%	68,8%	27%
I understand accountant's professional terminology			10,4%	70,8%	18,8%

From the data in Table 1. it is obviously that respondents have very good level of accounting and finance knowledge, because even 75% respondents have very good level of understanding the accounting process of the organizations, 68,8% respondents have very good level of understanding the contents of financial statements and 70,8% respondents have very good level of understanding accountant's professional terminology. Also, these results of a very good level of accounting and financial knowledge can be related to the previous mentioned respondents working experience and educational level. Furthermore, the respondents were asked by six questions to express a usage frequency of accounting information in the business, what are presented by the Table 2.

Table 2 Place and role of accounting information in the business

	1 never	2 rarely	3 sometimes	4 often	5 always	Median grade	Aver. grade	St. dev.
I use accounting information to make business decisions.			14,6%	37,5%	47,9%	4	4,33	0,72
Accounting information ensures better plan and control of business.			4,2%	37,5%	58,3%	5	4,54	0,58
I use accounting information to develop business cooperation			10,4%	62,5%	27,1%	4	4,17	0,59
When establishing business contacts, I consider the published financial statements of potential business partners.		2,1%	12,5%	47,9%	37,5%	4	4,21	0,73
I use accounting information to presents my business achievements.			6,3%	20,8%	72,9%	5	4,67	0,59
Accounting information ensures successful business cooperation.			12,5%	45,8%	41,7%	4	4,29	0,68

The responses from the data in Table 2. suggests a significant frequency of use of accounting information in the business, what is obviously by average grades which are

in each question above the Average grade "4 – often" with very low standard deviation from 0,58 to 0,73, what implies the significant place and role of accounting information in the business. Starting from the above results which implies significant place and role of accounting information in the business and from the fact that communication is vital component of every aspect of company business, to explore role of accounting information in the business communication process, the respondents were asked six questions to express an opinion of the importance and role of accounting information in business communication process.

Table 3 Importance and role of accounting information in the business communication process

	1 Strongly disagree	2 Disagree	3 Undecided	4 Agree	5 Strongly agree	Median grade	Aver. grade	St. dev.
Intuitive business communication is adequate in establishing and developing the first business contacts.	50%	37,5%	12,5%	0%	0%	1,5	1,63	0,70
I use accounting information in business communication	0%	0%	2,1%	39,6%	58,3%	5	4,56	0,54
Business communication based on accounting information is adequate in establishing and developing the first business contacts.			8,3%	50%	41,7%	4	4,33	0,62
Business communication based on intuition does not provide a true and fair view of available business opportunities.		2,1%	8,3%	47,9%	41,7%	4	4,29	0,71
Accounting information in business communication provides a complete insight into the business potential of business partner.			6,3%	20,8%	72,9%	5	4,67	0,59
Accounting information are the base of successful business communication.			6,3%	45,8%	47,9%	4	4,42	0,61

Data from the Table 3. implies that even 87,5% respondents (50% strongly disagree & 37,5% disagree with average grade 1,5 and standard deviation 0,70) consider that intuitive business communication is not adequate, until on the other hand even 91,7% respondents (50% agree & 41,7% strongly agree with average grade 4,33 and standard deviation 0,62) consider that business communication based on accounting information is adequate in establishing and developing the first business contacts. Likewise, 97,9% respondents (39,6% agree & 58,3% strongly agree with average grade 4,56 and standard deviation 0,54) use accounting information in business communication, 93,7% respondents (20,8% agree & 72,9% strongly agree with average grade 4,67 and standard deviation 0,59) consider that accounting information provides a complete insight into the business potential of business partner and 93,7% respondents (45,8% agree & 47,9% strongly agree with average grade 4,42 and standard deviation 0,61) consider that accounting information are the base for successful business communication. To determine if there is a significant difference between the means of two groups, which may be related in certain features, we employed T-test where it was necessary to satisfy the following T-test assumptions (Hayes, 2022):

- The first assumption made regarding t-tests concerns the ordinal scale of measurement. The assumption for a t-test is that the scale of measurement applied to the data collected follows a continuous or ordinal scale,
- The second assumption made is that of a simple random sample, that the data is collected from a representative, randomly selected portion of the total population.
- The third assumption is the data, when plotted, results in a normal distribution, bell-shaped distribution curve.
- The final assumption is the homogeneity of variance. Homogeneous, or equal, variance exists when the standard deviations of samples are approximately equal.

To test normal distribution of data we used Shapiro-Wilk W test for normal data. Results are shown in Table 4. After running this test, the null hypothesis regarding this test (variable is normally distributed) is not rejected.

Table 4 Shapiro-Wilk W test for normal data

Variable	Obs.	W	V	Z	Prob>Z
Intuitive business communication is adequate in establishing and developing the first business contacts.	48	0.94946	2.302	1.774	0.03804
Business communication based on accounting information is adequate in establishing and developing the first business contacts.	48	0.95849	1.891	1.355	0.08768

Since all assumptions of T-test are met, we used it and explored whether it exist a statistically significant difference between following assertions that "Intuitive business communication is adequate in establishing and developing the first business contacts" and that "Business communication based on accounting information is adequate in establishing and developing the first business contacts. The p value of T test was 0,000 so the analysis showed that there is a statistically significant difference between the above assertions, what imply conclusion that accounting information have a statistically significant role in the business communication process.

5. Conclusion

Accounting use to be a back-office profession and accountants use to treated as introverts, but nowadays business conditions completely changed the view on the accounting and accountants. Today, accounting is often called the language of business and plays a significant role in business management and accountants have become an important and active member of the management team. Accountants today have to possess a high level of communication skills which are crucial component of successful business. Also, previous research suggests the important and significant connection between communication skills and accounting professions i.e. that communication skills in the accounting profession were very important. Previously mentioned, on the one hand, suggests us important and significant connection between communication skills and accounting profession but on other hand we don't know whether companies use accounting information in business communication. So, with this paper we explore if the accounting information have a significant role in business communication process. The paper results show that accounting information have a

significant role in the business communication process, which is in collision with our starting assumptions.

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MODELLING VOLATILITY OF INDIVIDUAL STOCK ON ZAGREB STOCK EXCHANGE

Stjepan Laća, M.Sc.

University of Split, Department of professional studies, Split, Croatia
slaca@oss.unist.hr

Marko Miletić, Ph.D.

University of Split, Department of professional studies, Split, Croatia
mamiletic@oss.unist.hr

Anđela Andrijašević

FIS, Dugopolje, Croatia
andela2039@gmail.com

Abstract. Stock market and understanding of variables that impact its performance is one of the most researched topics in finance. Historical data of stock performance can serve as a guide for stock investments and potential returns that can be achieved in the future. Besides potential return other important measure is risk of investment. Risk of investment is usually measured by security's price volatility which can be defined as the price of security increase or decrease for a given set of returns. The most used measure of volatility of a security is standard deviation which is defined as a measure of dispersion of the probability of an event around its mean.

Previous papers on stock volatility on Zagreb Stock Exchange (ZSE) explored volatility of Crobex index and the way it gets influenced by the movement of the international financial markets and volume of traded stocks.

The aim of this paper is to research variables that have impact on volatility of an individual stock. Variables included in research are: market movement (Crobex index), presence of stock market maker, presence of dividend payout, volume traded of individual stock, Net Financial Debt (NFD)/ EBITDA ratio, Price to Earnings (P/E) ratio, Enterprise Value (EV)/EBITDA ratio, Return on Equity (ROE) ratio, Operating margin ratio and yearly revenue percent change. Research is done on data of companies included in the official stock index of the Zagreb stock exchange, Crobex (19 company was included on 31 December 2021) from 2010 to 2019 (before Covid-19 pandemic).

The data was taken from the Zagreb Stock Exchange website and from Thomson Reuters database where all data for selected companies necessary for this paper were collected.

Key words: *stock, volatility, business performance*

1. Introduction

When making an investment every investor wants to know expected return. But whenever making an investment investor must be aware of the risks of the investment. Usually risk of investment is measured by security's price volatility which can be defined as the average amount security's price differed from the mean over an observed period of time. It is measured by calculating the standard deviation of the annualized returns over a given period of time. Other most used measure of volatility is beta, it measures how an individual stock moves relative to the overall stock market.

For example, if an individual stock has a beta of 1 that means that a stock moves in a direction of the market as a whole. If a beta for a stock is lower than 1, this means that a stock has lower volatility than the broader market. The other way around is if the beta is higher than 1. Although beta as a measure of stock's volatility has its advantages and disadvantages, for this paper we took standard deviation, as a measure of stocks volatility.

When reviewing previous papers that have researched volatility of stock market in Croatia, we haven't found papers that researched volatility of individual stock on Zagreb stock exchange (ZSE). Aim of this paper is to find variables that have impact on volatility of an individual stock in Croatia. For the variables we chose the following: market movement (Crobex index), presence of the market maker for individual stock, presence of dividend payout, volume traded of individual stock, Net Financial Debt (NFD)/ EBITDA ratio, Price to Earnings (P/E) ratio, Enterprise Value (EV)/EBITDA ratio, Return on Equity (ROE) ratio, Operating margin ratio and yearly revenue percent change. Market movement is related with systematic risk, while all other variables are related to risk of individual stock (idiosyncratic risk).

For the sample we selected companies (19 stocks) included in the official stock index of the Zagreb Stock Exchange, Crobex as of the 31th of December 2021. From the initial sample which had 21 stocks, we excluded financial institutions (Zagrebačka banka and Hrvatska poštanska banka) because they didn't have some financial ratios as nonfinancial companies have.

We explored if any of the mentioned variables has statistically significant impact on stock price volatility in period of 10 years (from 01st January 2010 to 31th December, 2019 year). All the variables for which we found that have impact we included them in a model for volatility of an individual stock in Croatia. All the data for the research was taken from the ZSE website and from Thomson Reuters database.

2. Literature overview

In this section we reviewed the empirical literature of stock market volatility in general and for individual stock market volatility (idiosyncratic risk) in Croatia. Erjavec and Cota (2007) modelled stock market volatility for Crobex in Croatia and found that Crobex follows movements of the American stock exchange indices from the day earlier. In the same paper they found that the volume of trading was significant variable in explaining volatility of Crobex returns together with two European indices (DAX and FTSE100) in short run. The authors explored daily price movement for the period from January 4th 2000 to December 31th 2004. After them Sajter and Ćorić (2009) researched on explaining the impact of American Indices on Croatian stock market. And they came with similar conclusion exploring the data from January 3rd, 2005 to November 6th, 2008. Jošić and Žmuk (2021) did reappraisal of Erjavec and Cota paper, and Sajter and Ćorić paper. For the purpose of the analysis, they collected data for the period from 8th January 2010 to 9th October and paper provided evidence that Crobex movements strongly relies on the past information received from the American S&P500 stock market index. Also, they proved that there is co-movement between Crobex and main European indices on the same trading day and that volatility of Crobex stock market returns is positively correlated with the volume of trade on ZSE. Outside the papers that explored volatility of Crobex, we reviewed world literature that has focused

on volatility of individual stock. Malkiel and Xu (1999) decomposed volatility into two components: systematic volatility and idiosyncratic volatility (unsystematic risk). They researched data from January 1st, 1963 to 31st December, 1997 for daily returns and showed increase of idiosyncratic volatility. This increase does not show up in the volatility of returns for broad market indices, because it is diversified away in market portfolio. Roger and others (2017) did a study of 8.000 U.S. stocks over the period 1980-2014 and showed that small price stocks exhibit a higher idiosyncratic volatility than large price stocks. Also, paper highlighted that nominal prices are a strong determinant of idiosyncratic volatility of stock returns. Liu and others (2014) researched relationship between stock fundamental ratios and idiosyncratic volatility from 1993 to 2010 for Australian Securities Exchange listed companies. In this paper they showed that high idiosyncratic volatility stocks tend to be small (measured by size), highly leveraged (measured by interest cover ratio), low profitability (measured by return on equity and earnings per share), low valuation (measured by price to earnings ratio) companies. The regression analysis results showed that dividend yield was positively related to the idiosyncratic volatility. Price to earnings ratio and return on equity were negatively related to the idiosyncratic volatility. The relationships between the idiosyncratic volatility and the stock fundamental ratios remained robustness in presence of size. This paper inspired authors of this paper to research link between individual stock fundamental ratios, others variables that can impact volatility of individual stock and volatility of individual stock in Croatian stock market.

3. Variable and sample description

The aim of this paper was to find variables that statistically significantly affect volatility of an individual stock. Research was done in statistic software STATA. For the purpose of econometric data analysis, we employed static unbalanced panel data analysis. We collected data for companies (21 stocks) included in the official stock index of the Zagreb Stock Exchange, Crobex as of the 31st of December 2021. We excluded financial institutions (Zagrebačka banka and Hrvatska poštanska banka) from the research, because they didn't have some financial ratios as companies. So, sample finally had 19 large companies.

For the purpose of econometric data analysis, static balanced panel data analysis was employed. Model (2) forms the basis of estimation.

$$Y_{it} = c + \sum_{k=1}^K \beta_k X_{it}^k + \varepsilon_{it} \quad (2)$$

Where:

Y_{it} is the dependent variable, volatility of individual stock of company i at time t , with $i = 1, \dots, N$; $t = 1, \dots, t$

X_{it} are k independent variables for each year from 2010. to 2019.:

1. Volatility of market index (Crobex volatility)
2. Dummy variable - If the stock has market maker on Zagreb Stock Exchange – 1 –
3. Stock has market maker, 0 – Stock doesn't have market maker

4. Traded volume of the individual stock for the year
5. Financial ratio Net financial debt (NFD) to Earnings before interests, taxes, depreciation and amortization (EBITDA)
6. Yearly revenue percent change
7. Financial ratio price to earnings
8. Financial ratio Enterprise Value (EV) to Earnings before interests, taxes, depreciation and amortization (EBITDA)
9. Dividend yield in percent
10. Financial ratio Operating margin
11. Financial ratio Return on Equity

ε_{it} is the disturbance with z_i being the unobserved insurance-specific effect and u_{it} being the idiosyncratic error. The presented model is a one-way error component regression model where $z_i \sim IIN(0, \sigma_z^2)$ and independent of $u_{it} \sim IIN(0, \sigma_u^2)$.

The data was taken for 10 years period, from 2010. and 2019. (we didn't consider data for 2020 and 2021 because of Covid-19 pandemic and its impact on volatility of stocks), from the Thomson Reuters database for 19 large companies from Crobex, as earlier explained. From the Thomson Reuters database we collected financial information of companies for NFD/ EBITDA ratio, changes in revenue, price/earnings; Enterprise value / EBITDA ratio, dividend yield, operating margin ratio and return on equity ratio. From the Zagreb Stock Exchange (ZSE) we collected data of yearly volume traded for each stock, yearly volatility of Crobex (measured with standard deviation), yearly volatility of each individual stock and does stock has market maker. For calculating standard deviation of each stock, we took daily price movement of the stock for each observed year, calculated its price mean and based on that mean we calculated its standard deviation (yearly price volatility).

We researched all the collected data and tried to find if there was a statistically significant factors that impacted stocks volatility measured with standard deviation of the mean price movement for observed period.

4. Empirical Research

Descriptive statistics for all variables employed in research is provided in Table 1. Descriptive statistic is computed based on maximum of 164 observation for all variables.

Table 1 Descriptive Statistics

Variable	Obs	Mean	Std.Dev	Min	Max
Stock volatility	164	0.03	0.03	0.01	0.22
CROBEX volatility	164	0.01	0.00	0.00	0.01
Market Maker (MM)	164	0.32	0.47	0.00	1.00
Stock volume	164	93,560.69	152,540.80	22.00	1,262,587.00
NFD/ EBITDA	144	6.52	23.97	0.00	266.31

Revenue change	163	0.04	0.23	-0.75	1.00
P/E	122	29.70	51.22	0.29	402.82
EV/EBITDA	143	12.74	27.29	2.10	298.81
DY	164	0.07	0.45	0.00	5.24
OPM	164	0.01	0.23	-1.65	0.50
ROE	156	-0.20	2.84	-31.05	8.68

Source: author's calculation

First step in research was to check the problem of multicollinearity between independent variables. The matrix of Pearson correlation coefficients was implemented to test the problem of multicollinearity. Correlation matrix for independent variables is shown with table 2. An absolute value of the Pearson coefficient higher than 0.7 indicates a strong correlation between independent variables and as it can be seen there was no problem of multicollinearity between independent variables.

Table 2 Correlation matrix

	CROBE X volatility	MM	Stock volume	NFD/EBITDA	Revenue change	P/E	EV/EBITDA	DY	OPM	ROE
CROBEX volatility	1.00									
MM	-0.16	1.00								
Stock volume	0.14	0.05	1.00							
NFD/EBITDA	0.05	-0.07	-0.30	1.00						
Revenue change	0.04	0.09	-0.06	0.03	1.00					
P/E	0.16	-0.19	-0.12	0.16	-0.05	1.00				
EV/EBITDA	0.15	-0.09	-0.12	0.28	0.04	0.20	1.00			
DY	0.03	0.13	-0.03	0.10	0.36	-0.07	0.08	1.00		
OPM	-0.04	0.10	0.39	-0.05	-0.08	0.17	-0.38	0.03	1.00	
ROE	-0.14	0.11	-0.06	0.18	-0.21	0.08	-0.15	0.01	0.57	1.00

Source: author's calculation

Static panel model was used in research. F test, Breusch and Pagan Lagrangian multiplier test and Hausman test were used to show which panel model was the most appropriate one. To detect the problem of heteroscedasticity Breusch-Pagan test was used in research. In Breusch-Pagan test the null hypothesis assumes homoscedasticity is present. If the heteroscedasticity is present, the standard errors are biased which can lead to bias in test statistics and confidence intervals. If the problem of heteroscedasticity is present after finding proper static panel model robust standard errors were used in that same model. Table 3 shows the results of the analysis. In table 3 results of Breusch-Pagan test for heteroscedasticity, F test, Breusch and Pagan Lagrangian multiplier test and Hausman are also shown. Results

showed that the most appropriate model was with random effects (RE). Breusch-Pagan test for heteroscedasticity showed that problem of heteroscedasticity was present. After finding proper static panel model robust standard errors were used in model.

Table 3 Parameter estimates of static panel model with random effects.

Variable	Stock volatility
CROBEX volatility	0.0220873 (0.1855058)
MM	-0.0110179*** (0.0039413)
Stock volume	-1.29e-08 (9.76e-9)
NFD/ EBITDA	0.0009476* (0.0005582)
Revenue change	0.0081476 (0.0005582)
P/E	0.0000239 (0.0000209)
EV/EBITDA	-0.0003499 (0.0003937)
DY	-0.0021723 (0.0024956)
OPM	-0.021443 (0.0166627)
ROE	0.0020184 (0.0017015)
cons	0.0289178 (0.0080807)
R2 within	0.0676
R2 between	0.4773
R2 overall	0.3207
Model p-value	0
F-test	p value = 0.0000
Breusch and Pagan Lagrangian multiplier test	chi2 = 23.24
	p-value = 0.0000
Hausman specification test	chi = 11.83
	p value = 0.1591
Breusch-Pagan test for heteroskedasticity	chi2 = 29.66
	p-value = 0.0000

*, **, *** Statistically significant at the; 10%, 5%, 1% level, respectively. Robust standard errors are between parentheses.

Source: authors' work

Table 3 summarizes the final results of empirical analysis. The model with random effect is statically significant (p -value is 0.000). Table 3 shows that variable MM has negative and statistically significant influence on stock volatility while NFD/EBITDA has positive and statistically significant influence on stock volatility. MM is dichotomous variable where variable 0 means that there is no market maker for observed stock in observed year and variable take number 1 when there is market maker for observed stock. Results shows if there is a market maker, the volatility of the share is lower by 1.1% compared to when there is no market maker and that greater NFD/EBITDA ratio means greater stock volatility.

5. Conclusion

This paper researched variables that have impact on volatility of an individual stock of nonfinancial companies from official stock index, Crobex of the Zagreb Stock Exchange for the period from 2010 to 2019 year. Variables included in research were: market movement (Crobex index), presence of stock market maker, presence of dividend payout, volume traded of individual stock, Net Financial Debt (NFD)/EBITDA ratio, Price to Earnings (P/E) ratio, Enterprise Value (EV)/EBITDA ratio, Return on Equity (ROE) ratio, Operating margin ratio and yearly revenue percent change. Paper found that variable if stock has Market Maker has negative and statistically significant influence on stock volatility while NFD/EBITDA has positive and statistically significant influence on stock volatility. Both of these results are intuitive, because if stock has market maker, it always has bid and ask on market with reason to decrease price volatility. Also, if company has higher debt measured with NFD/EBITDA ratio it is logical that this company's stock will have higher volatility, because of the increase of risk of default for the company. All other factors in our research, haven't showed statistically significant impact on stocks price volatility. In this analysis, it can be argued that when analyzing financial ratios, it should have been taken in to the account that financial results lag price movement of the stock, although stock market is discounting mechanism and this issue can be subject of future papers.

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FINANCIAL MARKET AND FUNDAMENTAL DATA – THE CASE OF CROATIA

Jelena Vidović

University Department of Professional Studies, Split, Croatia
jvidovic@oss.unist.hr

Abstract. Stock price movement is in the focus of numerous scientific papers. Most of these researches were performed for Asia and US stock markets while very few researches deal with European emerging markets. In this paper we perform fundamental analysis in order to access connection of financial ratios with stock price and stock returns on Croatian stock market. We observe ten stocks from CROBEX 10 index from Zagreb Stock Exchange (ZSE) in four year period (2014 – 2017). CROBEX 10 is index of ZSE composed from top 10 CROBEX index constituents by Free Float Market Capitalization and Turnover. In selected period we observe five financial ratios: Debt to Equity Ratio (DER), Return on Assets (ROA), Current Ratio (CR), Price Earnings Ratio (PER), and Total Assets Turnover (TATO). We apply panel data regression analysis in order to investigate connection between selected financial ratios and stock prices and stock returns. Main characteristics of Croatian stock market are small number of quality stocks to be traded with and infrequent trading. According to these market characteristics two dependent variables were observed, stock price and stock return. Due to lack of substantial literature for observed market, proposed research design is based on the most frequently used financial ratios.

Key words: *stock price, stock returns, financial ratios, emerging markets, illiquidity*

1. Introduction

Accounting information from financial reports help investors in making investment decisions and predicting firm's future performance. The paper is focused on relationship between financial information presented through financial ratios and stock returns and stock price. According to investigation of selected problem in existing literature it can be seen that connection between accounting data and stock returns and stock prices has been extensively researched for developed markets such as US and South and South East Asia markets. European markets and particularly underdeveloped European stock markets have been poorly investigated. This article fills the gap in the existing literature by examining the predictability of stock returns based on the accounting information on Croatian stock market. Lack of previous researchs has affected the research design and selection of financial ratios taken into analysis. In this paper we use widely accepted research design and apply Panel Data Analysis and commonly used financial ratios. Selected financial ratios were observed in order to explain stock return and stock price. Some researches use stock price as dependent variable and other stock return. In this paper we compare these two research designs in order to give answer which of the two applied approaches gives better results.

Paper is divided into several sections: Introduction is followed by Literature review. Then, we present the section Data and Methodology, followed by Results and

discussion where the results of research are presented. In the last part Conclusions, the main conclusions are drawn and guidelines for further research are given.

2. Literature review

Aktaş and Ü. N. A. L. (2015) took three sets of efficiency ratios, which are namely cost, revenue and profit efficiency, as proxy, and run a regression analysis against stock prices for 7 insurance companies listed on Borsa Istanbul. Their findings suggest that all of employed models confirm statistically significant relationships between the ratios and stock prices. Among the three ratio groups, profitability ratios emerge as the best fit models. Alexakis et al. (2010) applied Panel data analysis to investigate whether fundamental information explain stock returns on Athens Stock Exchange (ASE) during the period from 1993 to 2006 by using accounting information. The sample was divided into three sub-periods based on the bull and bear periods observed on the ASE. They concluded that the selected set of financial ratios contains significant information for predicting stock returns. The findings reveal that the estimated coefficients of Net Profit Margin (NPM), Return on Asset (ROA) and Debt/Assets(DA) are not statistically significant in each of the three subperiods reported and were thus eliminated. However, consistent with the literature, liquidity ratios (asset turnover, current ratio) and profitability ratios (operating profit margin, return on equity) are significant and have a positive relationship with stock returns. Ligocká and Stavárek (2019) examined the relationship between selected financial ratios and the stock prices of food companies listed on selected European Stock Exchanges. Results showed that the relationship between selected financial ratios and stock prices of food companies is sporadic. It was found that Austrian stock prices are influenced by the ROE, the Polish stock prices are affected by the ROE, the ROCE and the NWC (the net working capital), and the Swiss stock prices are influenced by none of analysed financial ratios. Alajbeg et al. (2016) observed portfolios of stocks with lower P/E ratios against portfolios of stocks with higher P/E ratios as well as the aggregate market portfolio of Croatian equities. They concluded that no clear-cut relation could be observed between the level of P/E and subsequent risk-adjusted returns. Portfolios constructed with stocks with only positive earnings, regardless of their P/E level performed better than equally weighted market index form Crobex constituents. Since the market portfolio included every index constituent, which by definition also means stocks with negative earnings, the conclusion is that the market portfolio returns were brought down by those negative P/E stocks. Pražák and Stavárek (2017) observed the effect of financial ratios on the stock prices of select energy industry companies listed and traded on the Prague Stock Exchange and Warsaw Stock Exchange during the period 2006 – 2015. They revealed a positive impact of financial leverage ratio on stock prices in both countries and a negative effect of liquidity ratio on stock prices in both countries. Gardijan and Škrinjarić (2015) used Data Envelopment Analysis (DEA) for solving portfolio selection problem where a significant amount of data needs to be considered when making an investment decision. They calculated the efficiency scores for each stock in each window. They showed that more efficient stocks do create portfolios with higher returns. Gardijan and Škrinjarić showed that including financial ratios does make a difference and improves the efficiency and successfulness of a portfolio selection strategy on Croatian stock market.

3. Data and Methodology

The main objective of this paper is to examine connection between two independent variables: stock returns and average stock price and financial ratios from 10 firms from Zagreb Stock Exchange (ZSE). The data used in this study comprise annual stock prices, stock returns and financial ratios for a sample of 10 Croatian firms listed on the Zagreb stock exchange (ZSE) for the period from 2014 to 2017. All selected firms are members of CROBEX 10 index in January 2022. CROBEX 10 index constituents are top 10 CROBEX index constituents by Free Float Market Capitalization and Turnover. Observed stocks have been continuously traded during observed period (above 200 yearly observations), only one stock had insufficient number of observations in one year - RIVP in 2014. According to OECD Croatia in 2021 had less than half of the number of listed companies that it had in 2009. The stock market capitalisation represents only 0.25% of total EU stock market capitalisation, less than the country's share in EU GDP. Stock market lacks liquidity. In 2019, the turnover ratio of stocks on the Zagreb Stock Exchange was only 1.5%, compared with 19% for the Warsaw Stock Exchange, 9% for the Prague Stock Exchange and an average of 58% for stock exchanges in the EU. Panel data analysis is employed in order to investigate the relationship between stock returns / stock prices and selected financial ratios for 10 firms traded on ZSE over the period from 2014 to 2017. The analysis is performed using Panel data regression and related tests in order to identify the best model for the dataset. The financial data are gathered from audited consolidated financial statements of the CROBEX10 constituents. The financial statements as well as the stock prices of companies are obtained from Public Disclosure Platform of Zagreb Stock Exchange. The goal of the study is to measure five financial ratios: Debt to Equity Ratio (DER), Return on Assets (ROA), Current Ratio (CR), Price Earnings Ratio (PER), and Total Assets Turnover (TATO) and to test the connection between these ratios and stock prices and stock returns of all ten observed stocks. Stocks with negative income, net income and negative P/E ratios were not excluded from this research. Our choice of variables is product partly by recent studies and in part by the smallness of our data set. As a result, we obtain 5 ratios for each of ten firms for the whole period.

Table 1 Crobex 10 constituents in January 2022

Symbol	Issuer
ADPL	AD PLASTIK
ADRS2	ADRIS GRUPA
ARNT	ARENA HOSPITALITY GROUP
ATGR	ATLANTIC GRUPA
ATPL	ATLANTSKA PLOVIDBA
ERNT	ERICSSON NIKOLA TESLA
HT	HT
KOEI	KONCAR
PODR	PODRAVKA

Based on the previous research designs we selected financial ratios which were calculated from the consolidated and revised financial statements in period from 2014

to 2017. P/E ratios of CROBEX 10 stocks were calculated based on their average closing price in observed year. The procedure of calculation of dependent and independent variables used in model is given in Table 2. Number of stocks in each year was drawn from financial reports for each year of observed period. Number of stocks does not include firms own stocks.

Table 2 Definition of observed dependent and independent variables

Stock return on day t	Ln (last price on day t / last price on day t-1)	
Average stock return - AVRETURN	Sum of stock returns in one year period / number of observations in observed year	dependent
Average stock price - AVPRICE	Sum of last prices in one year period / number of observations in observed year	dependent
Current Ratio - CR	Current assets / current liabilities	independent
Debt to Equity Ratio - DER	Total debt / Equity	independent
Price Earnings Ratio - PER	Average stock price in observed year / (net income / average number of shares in observed year)	independent
Return on Asset - ROA	Net income / total assets	independent
Total Asset Turnover - TATO	Operating income / total assets	independent

The data was analysed by panel data regression analysis technique using three approaches - Common Effect, Fixed Effect, and Random Effect.

Common effects model neglects existence of time periods and that data refer to 10 individual firms but rather observes them as common sample. In this model intercept as well as slope are constant across all individuals and time periods.

In order to estimate Common Effects model following regression equation is applied:

$$y_{it} = \alpha + \beta X_{it} + \varepsilon_{it} \quad (1)$$

Where:

y_{it} is dependent variable,

x_{it} is independent variable,

α is the common intercept,

β ' slope - measures effect of x on y,

ε_{it} is error term.

Where N = Number of individuals and T is the number of time periods.

Fixed Effects model proposes slope which is equal for all individuals while intercepts are different or individual-specific.

Fixed effects model equation:

$$y_{it} = \alpha_i + \beta X_{it} + \varepsilon_{it} \quad (2)$$

The explication of variables is same as in Common Effects model.

In the Random Effect model, the difference between intercepts is accommodated by the error terms for each individual. It means that the error is calculated using two different terms: individual effects and one residual as a whole where the residual is a combination of cross section and time series.

Random effects model is estimated using following equation:

$$y_{it} = \alpha + \beta X_{it} + u_i + \varepsilon_{it} \quad (3)$$

ε_{it} - is the residual as a whole where the residual is a combination of cross section and time series.

u_i - is the individual residual which is the random characteristic of unit observation the i -th and remains at all times.

The explication of variables is same as in Common Effects model.

In order to decide which of these three approaches is more appropriate we apply two tests. The Breusch-Pagan Lagrange Multiplier test gives the answer if the Ordinary least squares method which is incorporated in Common effect model more appropriate than other two models. The next test is the Hausman test that identifies better model between Random Effects and Fixed Effects Model.

4. Results and Discussion

In order to reveal if there exists connection between observed variables correlation coefficients were estimated. Correlation coefficients (Pearson coefficient of correlation) and their probabilities are presented in Table 3. Variable AVPRICE which stands for average stock price in the observed year is strongly positively connected (correlation coefficient 0,80, significant under 1% probability) with TATO – total assets turnover. It seems that AVPRICE positively reacts to operating income and profit what can be seen from positive and statistically significant connection of AVPRICE with ROA and TATO. Current liquidity ratio is negatively strongly connected to Debt to Equity Ratio – DER (correlation coefficient -0,66, significant under 5% probability) as can be expected since these two financial ratios both refer to firm's capacity in debt fulfilment but in opposite directions. First is calculated as current assets over current debt while other represents total debt over total assets. Current ratio - CR is positively and significantly connected with ROA and PER. Debt to Equity Ratio is negatively correlated with ROA (correlation coefficient -0,41, significant under 5% probability). AVRETURN is correlated only with PER (correlation coefficient -0,41, significant under 5% probability). The estimated sign for the price/earnings ratio is negative indicating that companies with higher P/E ratios appear to have lower estimated returns.

Table 3 Correlation matrix with corresponding Probability

	AVPRICE	CR	DER	PER	AVRETURN	ROA	TATO
AVPRICE	1						
CR	0,27	1					
DER	0,16	-0,66**	1				
PER	0,12	0,34*	-0,18	1			
AVRETURN	-0,18	-0,31	0,10	-0,41*	1		
ROA	0,35*	0,41**	-0,41*	0,25	0,05	1	
TATO	0,80**	0,25	0,00	0,26	-0,22	0,55**	1

*Statistically significant under probability of 5%

**Statistically significant under probability of 1%

In the following part of the analysis Panel regression models; Common Effects, Fixed Effects and Random Effects models were estimated. Models are estimated for two dependent variables; AVPRICE and AVRETURN. First, we performed three above mentioned models for AVRETURN. In order to choose between best model estimator the LM test was performed. The null hypothesis for this test is that the Common Effects model is better than the other two models. Results of LM test are given in Table 4. Based on the output results null hypothesis cannot be rejected and the Common Effects model is chosen.

Table 4 Lagrange Multiplier Test, dependent variable AVRETURN

Effects Test	Statistic	d.f.	Prob.
Cross-section F	0.426212	-9,24	0.9078
Cross-section Chi-square	5.782.652	9	0.7615
Equation			
AVRETURN= C+CR+DER+PER+ROA+TATO			

Table 5 Panel Least Squares, dependent variable AVRETURN

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0,001344	0,000798	1.683.602	0,1017
CR	-0,000334	0,000255	-1.310.825	0,199
DER	0,0000583	0,000494	0,118026	0,9068
PER	-0,0000187	0,0000088	-2.135.205	0,0403
ROA	0,007099	0,003338	2.126.868	0,041
TATO	-0.000678	0,000438	-1.549.551	0,1308
R-squared	0.310839			
Adjusted R-squared		0.206421		
Prob(F-statistic)		0.025156		

The findings reveal that estimated coefficients of Current Ratio – CR, Debt to Equity Ratio – DER and Total Asset Turnover – TATO are not statistically significant in

explaining AVRETURN. However, Price Earnings Ratio – PER and Return on Asset - ROA are significant. The estimated sign for the ROA is positive indicating that companies with higher ROA appear to have higher estimated returns compared to companies with lower ROA. The estimated sign for the PER is negative indicating that companies with higher PER appear to have lower estimated returns compared to companies with higher PER. The P/E ratio compares stock price with company's earnings. Higher value of P/E ratio could mean that stock price is relatively high compared to earnings per share meaning that stock is possibly overvalued. Roughly it can be said that stock return of top 10 companies from CROBEX index is decreasing when P/E ratio increases indicating that stock return incorporates the notion that stock is overvalued.

After performing Panel Data Analysis and related tests in order to choose best model estimator for dependent variable AVRETURN in the following part of analysis we apply same procedure for second dependent variable stock price - AVPRICE. Results of LM test are given in Table 6. Based on the output results null hypothesis is rejected meaning that the Common Effects model is not appropriate and model must be chosen between Fixed effects model and Random effects model.

Table 6 Lagrange Multiplier Test, dependent variable AVPRICE

Effects Test	Statistic	d.f.	Prob.
Cross-section F	23.938.858	-9	0.0000
Cross-section Chi-square	89.711.296	9	0.0000
Equation			

AVPRICE= C+CR+DER+PER+ROA+TATO

Table 7 Hausman test, dependent variable AVPRICE

Test Summary	Chi-Sq. Statistic	Chi-Sq. d.f.	Prob.
Cross-section random	19.045.608	5	0.0019

The output indicates that the alternative hypothesis should be accepted and that Fixed Effects model is appropriate for computing the regression equation. The output of Fixed Effects model is shown in Table 8.

Table 8 Cross-section fixed (dummy variables), dependent variable AVPRICE

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	6.237.720	2.051.374	3.040.752	0.0056
CR	1.764.829	2.317.675	0.761466	0.4538
PER	0.340260	0.713008	0.477218	0.6375
DER	-1.222.933	6.936.177	-1.763.122	0.0906
ROA	-2.442.841	2.905.677	-0.840713	0.4088
TATO	1.151.150	2.416.040	-0.476462	0.6381
R-squared	0.974554			

Adjusted R-squared	0.959710		
Prob(F-statistic)	0.000000		

When observing output of Fixed Effects model multicollinearity can be noticed; very high standard errors for regression coefficients, exceptionally high R-squared while none of the coefficients is statistically significant. There have been no conclusions drawn regarding explanation of stock price with observed financial ratios in this research design. Connection of stock price and financial ratios should be further investigated.

5. Conclusions

In this paper Panel data regression analysis was performed in order to investigate connection between selected financial ratios and stock prices and stock returns of ten stocks from CROBEX 10 index. Three financial ratios: Debt to Equity Ratio (DER), Current Ratio (CR) and Turnover ratio (TATO), where not statistically significant in explaining stock returns, only two ratios were significant; Return on Assets (ROA) and Price Earnings Ratio (PER). The estimated sign for the ROA is positive indicating that increase in company's profit relative to assets results in higher stock return. The estimated sign for the PER is negative indicating that companies with higher stock price relative to its earnings have lower stock return. Observed stocks are top 10 stocks on Croatian stock market by Free Float Market Capitalization, Turnover and number of trading days. Negative coefficient of P/E ratio indicates that these top 10 stocks are overvalued. However, stock returns positively react to earnings (ROA). Alajbeg et al. (2016) also observed stocks with positive earnings in portfolio context and concluded that they performed better than equally weighted market index composed form Crobex constituents.

Model were dependent variable was stock price gave no usable results. According estimated correlation coefficients variable average stock price - AVPRICE is strongly significantly and positively correlated with Turnover ratio –TATO (correlation coefficient 0,80, significant under 1% probability). It can be said that rise in operating income relative to assets is positively correlated with average stock price. This connection between stock price and Turnover ratio should be further investigated and model that explains stock price on ZSE should be revisited.

Despite smallness of selected sample this research gives useful insight in explaining stock returns of quality stocks on ZSE. Conclusions relating top 10 stocks should not be extended to the whole market due to serious illiquidity issues of stocks on ZSE, (Vidović, 2020).

According to results it can be suggested that instead of the stock price as the dependent variable, the stock return should be considered for further research in this field.

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A REVIEW AND ANALYSIS OF METHODS FOR MEASURING COMPLIANCE WITH IFRS MANDATORY DISCLOSURE REQUIREMENTS

Dijana Perkušić

University Department of Professional Studies, Split, Croatia
dijana.perkusic@oss.unist.hr

Abstract. This paper analyses different methods for measuring the comparability of financial reporting of listed firms. In the past, scientists used different methods depending on the sample, namely time and number of countries or the number of firms. In the 1980s and 1990s, firms used national accounting standards or older versions of IASs issued before 2001, which allowed many alternative accounting methods to recognize and measure items in the financial statements. These studies used various indices, and according to them, the comparability of accounting practices increases when firms apply the same accounting methods to recognize and measure items in the financial statements. Since 2005, the financial reporting framework of the EU Member States has been harmonized by introducing the mandatory application of IFRS for listed firms. Today, 144 countries permit or require IFRSs for domestic listed firms, so scientists are focused on measuring the compliance levels of listed firms with IFRS mandatory disclosure requirements. This paper highlights the importance of the method used to measure compliance with IFRS mandatory disclosure requirements, due to the significant differences that may arise from the use of the different methods. The number of disclosure items required by different standards varies considerably, some standards require a large number of items to be disclosed (e.g. IAS 1 "Presentation of financial statements") whilst some others require only a few (e.g. IAS 2 "Inventories"). This may become a significant problem when studies examine compliance with IFRS mandatory disclosures because standards that require more items to be disclosed are unintentionally not treated equally with those that require fewer items to be disclosed. The main purpose of this paper is to identify used methods in the literature on compliance with IFRS mandatory disclosure requirements for the post-2005 period. The paper highlights the fact that scientists and all interested parties in financial reporting, must be cautious when interpreting the research results of prior studies on compliance with IFRS mandatory disclosure requirements due to the implications of the used method. Based on the given review, the paper suggests and highlights the importance of measuring compliance with IFRS mandatory disclosure requirements in future studies using simultaneously different methods.

Key words: *International Financial Reporting Standards, financial reporting, mandatory disclosure, compliance, literature review*

1. Introduction

Financial reporting and accounting information is essential for the efficient functioning of the capital markets. Nowadays, the comparability of financial reporting is crucial for investors from different countries. In the past, multinational firms were obliged to produce several financial statements, all depending on the accounting regulations of the different capital markets in which they were listed. Investors were confused by these differences between the financial positions reported under the various accounting standards. Because of that, scientists used different methods for

measuring the comparability of financial reporting of listed firms depending on the sample, namely time and number of countries or the number of firms. In the 1980s and 1990s, firms used national accounting standards or older versions of IASs issued before 2001, which allowed many alternative accounting methods to recognize and measure items in the financial statements. These studies used various indices, and according to them, the comparability of accounting practices increases when firms apply the same accounting methods to recognize and measure items in the financial statements. The value of the index shows how comparable the financial statements are at any given time, while changes in value measure an increase or decrease in comparability over time.

In order to improve transparency and to achieve harmonization of financial reporting, the EU requires listed firms to prepare their consolidated financial statement in compliance with the IFRS from 2005. IFRS are the crucial means to achieve more reliable, credible, and comparable financial information at an international level. Users can correctly interpret the financial information and thus easier make decisions based on that information using a single set of accounting standards. Today, 144 countries permit or require IFRSs for domestic listed firms, so scientists are focused on measuring the compliance levels of listed firms with IFRS mandatory disclosure requirements. Hodgdon et al. (2008) pointed out that "the extent of compliance with accounting standards is as important as the standards themselves", so today academic focus shifts from accounting standards to IFRS compliance practices.

The global application of IFRS does not imply the complete compliance in practice. To measure firms' financial reporting compliance with IFRS, the authors use different methods. There are two commonly used approaches: "dichotomous approach" and "partial compliance unweighted approach". Users of academic papers from this stream of research must be aware that the research results can depend on the measurement method in the empirical study. This paper aims to identify used methods in the literature on compliance with IFRS mandatory disclosure requirements for the post-2005 period. The paper highlights the fact that scientists and all interested parties in financial reporting must be cautious when interpreting the research results of prior studies on compliance with IFRS mandatory disclosure requirements due to the implications of the used method.

The remainder of this paper is organized as follows. First, this paper defines the comparability of financial reporting and the development of methods for measuring it. Section 3 describes the most used methods for measuring compliance with IFRS mandatory disclosure requirements after 2005 and discusses their difference. Section 4 presents the review of used measurement methods in IFRS compliance studies. Based on the given review, section 5 concludes the paper and suggests directions for future research.

2. Development of methods for measuring the comparability of financial reporting

First, it is necessary to describe the development of different approaches to measuring firms' comparability accounting practices that have emerged throughout history. Many previous studies examined the compatibility of the firm's accounting policies or the disclosure compatibility because, in the 1980s and 1990s, firms used national

accounting standards or older versions of IASs issued before 2001 that allowed many alternative accounting methods to recognize and measure financial statements. In general, scientists defined the comparability of firms' accounting practices as de facto harmonization of financial reporting.

Scientists decide at their discretion and concerning the goal of research for a particular approach to measuring the level of harmonization (Van der Tas, 1992). The authors used various indices in these studies, the most well-known being the indices developed by van der Tas (1988) or their improved versions (Archer et al., 1995; Herrmann and Thomas, 1995; Krisement, 1997; Emenyonu and Adhikari, 1998; Cañibano and Mora, 2000; Aisbitt, 2001; Parker and Morris, 2001; Taplin, 2003).

According to scientists who use these indices, the comparability of accounting practices increases when firms apply the same accounting methods to recognize and measure the positions of financial statements. Van der Tas developed three indices, namely H, C and I index. These indices are based on measuring options' concentration and are used for measuring the level of de facto harmonization of financial reporting. The value of those indexes shows the compliance level of firms' choices between alternative accounting methods for recognition and measurement and the disclosure requirements. Taplin (2004) introduced the T index to quantify the degree to which firms' financial statements are comparable. T index shows the probability that two randomly selected firms from the same or different countries have comparable statements or the average comparability of pairs of firms.

Van der Tas (1992) states that the adoption and use of IAS can improve harmonization. Therefore, there is a connection between the international harmonization of financial reporting and compliance with IAS. However, in the 1980s and 1990s, IASs allowed various alternative methods. Their application was not mandatory, so Van der Tas (1992) emphasizes the questionable role of compliance with IASs in improving the harmonization process in the observed period. Many firms can apply the same accounting method; in that case, the high calculated values of the H, C and I indices show a high level of harmonization of the firm's accounting practice. However, compliance with IASs is low if IASs do not permit the applied method. Furthermore, the application of IASs in the period under review allows firms to choose between many alternative accounting methods, the application of which will, in turn, reduce the comparability of financial statements if firms do not apply the same accounting methods. Selected accounting methods affect the value of individual positions in the firm's financial statements and thus affect the comparability of published accounting information.

Tower et al. (1999) emphasize the inadequacy of using the H, C, and I indices in studies of financial reporting compliance with IASs that require measuring compliance with many requirements in IASs and applying complex statistical methods and techniques. To conduct the research, the authors use indices that measure the level of compliance of the firm's financial reporting with the requirements prescribed by IAS in the 1990s.

The implementation of IFRS around the world has not eliminated the need for further research in the field of financial reporting harmonization; only studies shifted focus from accounting standards to IFRS compliance practices. That is not surprising because more than 100 countries use IFRS, so the question is, what about the actual level of

firms' compliance with IFRS. Consequently, scientists developed new methods for measuring compliance with IFRS. The following section describes the two most used measurement approaches in IFRS compliance studies after 2005.

3. Methods for measuring the level of compliance of a firm's financial reporting with the IFRS mandatory disclosure requirements

The first step in measuring firms' financial reporting compliance in relevant IFRS compliance studies is to separate the disclosure requirements from the recognition and measurement requirements prescribed by IFRSs. Subsequently, most studies at the time of IFRS mandatory application measure firms' compliance with the IFRS mandatory disclosure requirements. Glaum et al. (2013), Cascino and Gassen (2015), Mnif and Borgi (2020) point out that a precise measurement of firm compliance with recognition and measurement requirements is impossible without access to internal, private firm information.

Tsalavoutas et al. (2010) conducted the first study that analyzes in detail, compares research approaches and methodological frameworks for measuring the level of compliance with IFRS, and presents the advantages and disadvantages of each method, statistically testing the significance of differences in results using both methods. That represents a significant step forward in scientific research in the field of financial reporting and harmonization. Therefore, the following are methodological insights crucial for measuring the level of compliance of a firm's financial reporting with IFRS.

The most common approach to measuring compliance with the IFRS mandatory disclosure requirements is the "dichotomous disclosure index approach", an unweighted disclosure index used in many previous studies. The disclosure index for each firm is calculated as the ratio of the total number of required disclosure items provided by the firm (for all IFRSs under analysis) to the maximum possible score applicable for that firm. ranges from zero to one. According to the previous studies (Street and Gray, 2001; Tsalavoutas et al., 2010; Santos et al., 2014), to calculate such an index, the following formula applies:

$$C_X = \frac{TT_X}{AT_X} = \frac{\sum_{IFRS}^N T_{X, IFRS}}{\sum_{IFRS}^N A_{X, IFRS}} \quad (1)$$

Where:

- C_X is the compliance index of firm X with disclosure requirements from IFRSs according to the dichotomous approach;
- TT_X is the total number of disclosure requirements from applicable IFRSs;
- AT_X is the maximum number of applicable IFRS requirements items applicable for firm X;
- N is the total number of applicable IFRSs for firm X.

This index is an unweighted index because each disclosure item receives equal weighting. The unweighted index, i.e. a method that gives equal weight to each item, does not have a unique name; for example, Tsalavoutas et al. (2010) use the term "C" in its description and interpretation, Street and Gray (2001) "DIS 2", and Santos et al.

(2014) "DD". Cooke used this method in his studies (1992, 1998), so it is often called the Cooke's method in the literature (hereafter Cooke's method). If the required item is disclosed, the firm gets 1 point; in the case of noncompliance, the firm gets 0 points. However, some IFRSs (requirements) are not applicable to every firm, and in that case, such IFRSs (requirements) are classified as "not applicable". Therefore, it is not strictly dichotomous because no applicable IFRS requirements do not influence the index calculation (Cooke, 1992).

However, each IFRS has a significantly different number of mandatory disclosure items; some standards require many disclosure items (e.g., IAS 1 "Presentation of financial statements") while others require only a few (e.g., IAS 2 "Inventories"). Therefore, this method gives more weight, i.e., importance to those standards requiring a larger number of disclosure items, which is an important limitation distinguishing this index from other indices. Every IFRS is equally important, so Tsalavoutas et al. (2010), Santos et al. (2014), Ponce et al. (2016) emphasize the need to apply a method that gives equal weighting to each standard regardless of how many requirements it contains, and this is especially important when the research includes IFRS that differ significantly in the number of disclosure requirements.

The "partial compliance unweighted approach" in which each IFRS has the same weight is calculated using a two-step procedure. The first step for every sampled firm is to calculate the compliance disclosure score for one standard (Street and Gray, 2001; Tsalavoutas et al., 2010; Santos et al., 2014) for every applicable IFRS:

$$D_{IFRS, X} = \frac{T_{X, IFRS}}{A_{X, IFRS}} \quad (2)$$

Where:

- $D_{IFRS, X}$ is the compliance disclosure score for analysed IFRS of the firm X;
- $T_{X, IFRS}$ is the total number of disclosed requirements for analyzed IFRS by firm X;
- $A_{X, IFRS}$ is the maximum number of applicable requirements of analyzed IFRS for firm X.
-

In the second step for each firm X, it is necessary to calculate the total index of compliance with the applicable IFRS by adding indexes for compliance with each IFRS and dividing it by the number of applicable IFRSs (Street and Gray, 2001; Tsalavoutas et al., 2010; Santos et al., 2014):

$$PC_X = \frac{\sum_1^N D_{IFRS, X}}{N} \quad (3)$$

Where:

- PC_X is the total compliance index of firm X with disclosure requirements of all applicable IFRSs according to the partial compliance unweighted approach;
- $D_{IFRS, X}$ is the compliance disclosure score for analysed IFRS of the firm X;
- N is the total number of applicable IFRSs for firm X.

It is also called a weighted index because a requirement within IFRS does not receive equal weight (Tsalavoutas et al., 2010). The weighted index, i.e. the method that values each IFRS equally, does not have a unique name; for example, Tsalavoutas et al. (2010) use the term "PC" in its description and interpretation, Street and Gray (2001) "DIS 1", and Santos et al. (2014) "DP" (hereafter PC method).

Compliance index ranges from zero to one. Tsalavoutas et al. (2010) conducted a study using both methods for measuring compliance with the IFRS mandatory disclosure requirements. The obtained results differ significantly depending on the applied method, i.e. the method that gives equal weighting to each disclosure requirement (Cooke's method) resulted in greater compliance with IFRS. After the research, the authors examined the significance of the disclosure requirements prescribed by IAS 1 on the obtained research results, given that IAS 1 contains the largest number of requirements. The results of measuring the IFRS compliance level obtained using the method that gives equal weighting to each requirement (Cooke's method) were 10% lower after excluding the requirements of IAS 1 (statistically significant at the 1% level). On the other hand, the results of measuring the IFRS compliance level obtained using the method that gives equal weighting to each standard (PC method) were lower by approximately 1% after excluding the requirements of IAS 1 (statistically significant at the 1% level). Given the study results, Tsalavoutas et al. (2010) recommend the simultaneous application of both methods to obtain as accurate results as possible. Tsalavoutas et al. (2010) question the results of previous research (Street and Bryant, 2000; Glaum and Street, 2003; Hodgdon et al., 2008), and the authors question the robustness of prior research if, in addition to the used method, the authors also applied a method that gives equal weighting to each standard. They also raise the question of whether the same previously identified firm characteristics would be statistically significant in explaining the influence on the level of IFRS compliance using the other approach.

Tsalavoutas et al. (2010) point out that the question of the applicability of an individual IFRS to a firm is a limitation of these two methods. When examining compliance, the researcher must determine whether an observed IFRS disclosure requirement (or IFRS) is not applicable to the firm or whether it is a firm non-compliance with the observed IFRS disclosure requirement (or IFRS). To avoid penalizing a firm for non-compliance with IFRSs that may not be applicable to that firm at all, Tsalavoutas et al. (2010) state that it is necessary to conduct a thorough reading of the complete annual report before starting with the process of assessment of firms' compliance level with IFRS. They used this approach in their research.

The studies which examine the compliance of firms' financial reporting with IFRS include different IFRS, i.e. each IFRS consists of a different number of requirements that prescribe the scope and content of financial reporting. Therefore, Tsalavoutas et al. (2010) conclude that a method that gives equal weighting to each IFRS can provide more accurate results than a method that gives equal weighting to each requirement.

In some cases, the applicability of the standard or the requirement can be verified directly from disclosed positions in the Balance Sheet or Income Statement (Santos et al., 2014). In other cases, information on the applicability of the standard can be found only in the Notes to the financial statements. However, there is no regulation defining that firms must state not applicable standards in the Notes. Santos et al. (2014)

emphasize this issue and develop two alternative criteria for measuring the compliance of firms' financial reporting with the IFRS mandatory disclosure requirements:

- Criterion 1 - "strict" criterion: If there is no information in the Notes about a particular IFRS, it is considered that the IFRS is applicable, i.e. this strict criterion implies that the firms must disclose which standards are not applicable to them; otherwise, all requirements prescribed by a particular standard are treated as non-disclosed, and the firm gets 0 points for them. This criterion penalizes firms that do not disclose relevant information and thereby mislead users into concluding that a particular IFRS is not applicable to their firm when it is. On the other hand, adhering to this criterion, there is a risk of penalizing those firms that do not disclose information on IFRS that are not applicable to them.
- Criterion 2 - "tolerant" criterion: If the Notes do not contain information about a particular IFRS, it is considered that this IFRS is not applicable. That tolerant criterion implies that the firm is not obliged to disclose which standards are not applicable to them. Therefore, all requirements prescribed by standards that are not applicable to the firm are omitted from the calculation of the index value. This criterion does not penalize those firms that do not publish information on IFRS that are not applicable to them but tolerate this non-disclosure. On the other hand, using this criterion, there is a risk of considering that all omitted information results from non-applicable standards.

Following Santos et al. (2014), these two criteria approach enables the measurement of the maximum (tolerant) and minimum (strict) compliance level, thus enabling to assess the sensitivity of the results due to the interpretation of standard non-applicability.

4. A review of methods for measuring compliance with IFRS mandatory disclosure requirements after 2005

Table 1 shows the used approaches for measuring compliance with IFRS mandatory disclosure requirements after mandatory IFRS implementation.

Table 1 A review of methods for measuring compliance with IFRS mandatory disclosure requirements after 2005

Approaches for measuring compliance with IFRS mandatory disclosure requirements	Study
Cooke's method ("Dichotomous disclosure index approach")	Fekete, Matis̄ and Lukács (2008); Al Mutawaa and Hewaidy (2010); Glaum, Schmidt, Street and Vogel (2013); Demir and Bahadir (2014); Lopes (2014); Cascino and Gassen (2015); Bagudo, Manaf and Ishak (2016); Tahat, Mardini and Power (2017); Dawd (2018); Florio et al. (2018); Mazzi, Slack and Tsalavoutas (2018); Ali (2021).
PC method ("Partial compliance unweighted approach")	Appiah, Awunyo-Vitor, Mireku and Ahiagbah (2016); Mnif and Borgi (2020).
Cooke's method and PC method simultaneously	Tsalavoutas (2011); Amiraslani, Iatridis and Pope (2013); Santos, Ponte, and Mapurunga (2014); Tsalavoutas, André,

	and Dionysiou (2014); Ponce, Hlaciuc, Mateş and Măciucă (2016); André, Dionysiou and Tsalavoutas (2018); Tawiah and Boolaky (2019).
Others	Verriest, Gaeremynck and Thornton (2013): Counting items
	Lucas and Lourenço (2014): Adjusted Cooke's method
	Devalle, Rizzato and Busso (2016): PC method and Cooke's method both unweighted and weighted.

Source: Author

The given review shows that the Cooke's method is the most common approach in IFRS compliance studies after 2005. This approach that gives equal weight to each requirement within all standards has also been used in many IFRS studies before the mandatory implementation of IFRS in 2005 (e.g., Cooke, 1992; Cooke, 1998; Street and Bryant, 2000; Street and Gray, 2001; Glaum and Street, 2003; Al-Shammari et al., 2008). Using that approach, we cannot see the compliance score for every observed IFRS. The second limitation is that the low compliance with certain IFRSs can be obscured by the high compliance with other IFRS, so calculated value of C index may be misleading as it is affected by compliance with only one IFRS. IAS 1 is well-known accounting standard and prescribes non-complex disclosure requirements, so the majority of firms tend to comply with its requirements and thus driving the overall compliance score upwards. C index gives IAS 1 higher weight compared to other IFRSs with a smaller number of disclosure requirements.

In contrast, measuring compliance with each standard provides an opportunity to identify the standards or specific requirements for which the most outstanding non-compliance has been identified and examine the reasons for the non-compliance found. In addition, such a method can help identify standards that are not applicable to firms with similar characteristics. In studies conducted by Appiah et al. (2016), and Mnif and Borgi (2020), authors used only a method that gives equal weighting to each standard.

From a methodological point of view, in their studies, Tsalavoutas (2011) and Tsalavoutas et al. (2014) employ two methods for measuring compliance with IFRS mandatory disclosures and test the significance of the differences in the compliance scores identified. Consequently, these studies consider only those independent variables being significant under both methods as valid findings. Consistent with the findings of Street and Gray (2001) and Tsalavoutas et al. (2010), Tsalavoutas (2011) showed that the two methods employed produce significantly different compliance scores; the Cooke's method produces significantly higher scores than the PC method. Tsalavoutas (2011) pointed out that the "Wilcoxon test" indicates that the ranking of firms based on the compliance scores changes depending on the method employed.

Santos et al. (2014) found that the average level of compliance with IFRS required disclosure was very sensitive to the measurement approach employed, varying more than 100%, that is, from 16.04% to 33.72%. In addition, it is interesting to observe compliance with each IFRS. Tawiah and Boolaky (2019) reported high variations in the

level of disclosures across the standards. Over the years, IAS 18 (Revenue) recorded the highest compliance level of 100%, probably because of the few and common requirements. The high-scoring standards mostly have fewer disclosure requirements and are fundamental to all firms (IAS 33, IAS 10, IAS 7 and IAS 23). The lowest scoring standards included IAS 37, IFRS 13, IAS 17 and IAS 19. Except for Santos et al. (2014), all authors assumed that if certain IFRS is not mentioned in Notes to financial statements (there are no related positions disclosed in other financial statements), such IFRS is not applicable. Its disclosures are not included in the calculation of the IFRS compliance index.

Verriest et al. (2013) followed a Counting items approach, so the research results are not expressed as a percentage. The level of IFRS compliance is expressed in points by a simple calculation of the total number of disclosed items. The obtained research results show that the level of compliance is 14 out of a possible maximum of 15 points.

Lucas and Lourenço (2014) evaluated whether an item is fully (1 point), partially (0.5 points), or not disclosed (0 points). That is not a standard dichotomous measurement scale, so it is called "Adjusted Cooke's method". Devalle et al. (2016) used four measurement approaches in their IFRS compliance study: PC method and Cooke's method, both unweighted and weighted. Authors emphasized the reasons for that: "due to the different Dscore configurations used by the main studies on the topic, and in order to prevent the analysis from being influenced by the Dscore configuration used, this paper calculates four Dscore configurations" (Devalle et al., 2016).

Cooke's method (weighted) weights each disclosure item by the percentage of firms in the sample that do not comply with the item. As the result of that coding, rarer (more common) applicable disclosures receive higher (lower) weights.

Although each measurement approach has its advantages and disadvantages, it is advisable to use more approaches and check whether empirical findings are robust with applying alternative compliance indexes (Tsalavoutas, 2011; Amiraslani et al., 2013; Santos et al., 2014; Tsalavoutas et al., 2014; Ponce et al., 2016; André et al., 2018; Tawiah and Boolaky, 2019).

5. Conclusion

Financial statements provide investors with information about the firms' financial position and performance, thus enabling investors to compare disclosed firms' information with its competitors, whether based in the same country or abroad. IFRSs give the opportunity to compare financial statements of listed firms worldwide or to compare financial statements of the same firm for a longer period because using IFRSs, transparency of financial reporting increases and decreases the number of allowed accounting methods for measurement, recognition and presentation.

The global application of IFRS does not imply the complete compliance in practice. There are two commonly used approaches to measure firms' financial reporting compliance with IFRS: Cooke's method ("dichotomous approach") and PC method ("partial compliance unweighted approach"). Users of academic studies from this stream of research must take care when they read the findings of a study examining compliance with IFRS disclosure requirements if only one method has been used. The research results can depend on the measurement method employed in the empirical study: statistical significance of independent variables in the regression model and the

level of IFRS compliance score as the dependent variable. A key variable in IFRS compliance studies is the index employed to measure compliance with IFRS disclosure. According to the IFRS compliance literature, we can use an index that gives each IFRS the same weight, or we can use an index that gives each IFRS disclosure requirement item the same weight. When deciding which type of index to use, the authors in the majority of cases (Fekete et al., 2008; Al Mutawaa and Hewaidy, 2010; Glaum et al., 2013; Demir and Bahadir, 2014; Lopes, 2014; Tahat et al., 2017; Dawd, 2018; Mazzi et al., 2018) used the unweighted disclosure index. Only two studies (Appiah et al., 2016; Mnif and Borgi, 2020) use the weighted disclosure index, giving each IFRS the same weight. Although each type of index has its advantages and disadvantages, it is advisable to use both approaches and check whether the empirical findings are robust when applying alternative compliance indexes (Tsalavoutas, 2011; Santos et al., 2014; Tsalavoutas et al., 2014; Ponce et al., 2016; André et al., 2018; Tawiah and Boolaky, 2019).

In IFRS compliance studies, it is impossible to exclude researcher subjectivity in coding completely, but the researcher can take certain steps to minimize it. To minimize subjective bias during the assessment of firms' IFRS compliance, it would be useful that the same researcher read full annual report and collect data. According to Santos et al. (2014) authors can apply two criteria for applicability of IFRS to a firm. An important feature of the compliance index is that it ranges from zero to one; consequently, such a variable is usually not normally distributed. Therefore, before the regression analyses, authors need to transform disclosure indexes to achieve variable normality. Tsalavoutas et al. (2010) explained in detail that the two most common methods can, and their findings proved significantly different overall and relative compliance scores.

The findings of Tsalavoutas (2011), Tsalavoutas et al. (2014), Santos et al. (2014) support this argument. These findings illustrate how sensitive the scores produced under Cooke's method might be to the number of items mandated by the standards included in the research instrument. Thus, scientists and all interested parties in financial reporting may draw misleading conclusions about how firms comply with mandatory disclosures. Accordingly, these findings strengthen the proposition for researchers to employ both methods to avoid misleading conclusions when conducting this type of research. That may also have econometric implications regarding the findings relating to the factors explaining compliance.

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TO WHAT EXTENT ARE SMALL OPEN ECONOMIES EXPOSED TO FOREIGN CAPITAL? INSIGHTS INTO FELDSTEIN-HORIOKA PUZZLE IN CEE COUNTRIES

Tino Kusanović, PhD

University of Split, University Department of Professional Studies, Split, Republic of Croatia
tinok@oss.unist.hr

Abstract. The aim of this paper is to provide an insight into recent trends in the relationship between domestic savings and investment (F-H puzzle) on the example of Central and Eastern European countries, and in the context of crises and levels of development, i.e. GDP per capita. In relation to the available research, this paper classifies and presents recent literature with regard to the methods of analysis used and the theoretical approach. Furthermore, the role of foreign savings as a possible complement to domestic savings to finance domestic investments will be considered, as well as risks to the macroeconomic stability of a particular country. Namely, although foreign capital (primarily foreign direct investment) is developmentally welcome, the dominant financing of domestic investments with foreign capital can lead to the emergence of crowding out domestic savings. Consequently, there is an increase in the dependence of the domestic economy on foreign savings, the creation of macroeconomic imbalances and the deepening of current account deficit. Finally, the paper makes recommendations for achieving positive and stable GDP growth rates based on domestic savings. Only growth based on domestic savings protects the country from external risks and emerging disturbances in financial markets due to the onset of the financial crisis

Key words: capital flows, F-H puzzle, CEE countries, domestic savings

1. Introduction

The origin of the Feldstein-Horioka puzzle, which is considered one of the major puzzles in international economics, rests with the seminal paper of Martin Feldstein and Charles Horioka, published in 1980 in Economic Journal, whereby they estimated a cross-section regression of this form:

$$\left(\frac{I}{Y}\right)_i = \alpha + \beta \left(\frac{S}{Y}\right)_i, i = 1, 2, 3, 4 \dots N \quad (1)$$

where I is domestic investment (private and public) in country i , S is domestic savings (private and public) for country i , and Y is GDP. In this equation the coefficient β has the most important role and is called the Feldstein-Horioka coefficient (saving retention coefficient) or the link between domestic savings and investment. The value of β ranges between 0 and 1. If $\beta = 1$ there is a 100% correlation between domestic investment and domestic savings. This means that there is no foreign investment in the country, i.e., capital mobility is zero. Another extreme situation is when $\beta = 0$, where overall domestic investment is financed with foreign capital, which indicates perfect capital mobility. In this context, the question arises of the influence of foreign savings (capital) on the financing of domestic investments, i.e. whether the inflow of foreign capital leads to the displacement (reduction) of domestic investment activity.

In the case of perfect capital mobility, increasing the rate of savings in certain country will cause an increase in investment in all countries, where the distribution of increased capital among countries will vary positively with the initial mass of each country's capital. The Feldstein and Horioka hypothesis is that a high positive correlation between domestic savings and investment indicates low capital mobility. This means that domestic savings are transformed into domestic investment with foreign capital playing a marginal role. To investigate this relationship they used data for 16 OECD countries for the period 1960-1974. Authors found a value of the β coefficient close to 1 (0.89), which contradicts the theory of perfect capital mobility according to which capital moves seeking the highest rates of return. Since 1980 papers and researches were conducted on the subject of domestic savings and domestic investments in the context of capital mobility trying to explain this phenomenon. In accordance with the above, the aim of this paper is to briefly present the theoretical framework of the F-H puzzle and the connection of the phenomenon with the international capital movement (Chapter 2). Furthermore, a brief overview of previous research on the F-H puzzle on a predominantly sample of CEE countries will be presented (Chapter 3). In the empirical part of the paper, a simple panel model will test the relationship between domestic savings and domestic investment in a sample of 11 CEE countries for the period 1995-2020 (Chapter 4). Chapter 5 presents the conclusions

2. Theoretical foundation of F-H puzzle

As mentioned in the introduction section of the paper, Feldstein and Horioka (1980) interpret high savings-investment correlation as an indicator of capital immobility. From the current account identity:

$$\text{Current Account}_t = S_t - I_t = -\text{Financial Account}_t \rightarrow I_t = FA_t + S_t \quad (2)$$

F-H identity argued that if there is perfect capital mobility, we should observe low correlation between domestic Investment and savings. Investors in one country do not need the funds from domestic savers and can borrow from international markets at world rates. By the same token, savers can lend to foreign investor the entirety of the domestic savings. This concept related to long-term real capital flows.

In the last several decades numerous studies have attempted to explain and solve the Feldstein Horioka puzzle. Some of these empirical studies found high values for the β coefficient and accepted the existence of the puzzle (Penati and Dooley, 1984; Feldstein and Bachetta, 1991; Coakley et al. 2001), whereas another strand of studies (Sinn, 1992; Coakley et al., 2004; Ketenci, 2010) obtained values close to zero and hence declined the claim of Feldstein and Horioka. Between these two (extreme) groups of findings are those who accepted the existence of a high correlation between domestic savings and investment, but not the fact that the high β coefficient indicates low capital mobility. According to them, in countries where perfect capital mobility exists, savings and investment are highly correlated under the influence of some factors such as size of the country (Harberger, 1980; Murphy, 1984), the effect of the European Union (Feldstein and Bachetta, 1991), the degree of development of the country (Dooley et al., 1987; Sinn, 1992; Sinha and Sinha, 2004), the degree of openness of the economy (Bahmani-Oskooee and Chakrabarti, 2005).

Several authors accepted the high correlation between savings and investment as empirical evidence, but refused to accept that it indicates low capital mobility (Murphy, 1984; Sinn, 1992; Taslim, 1995). They showed that, even in models where perfect capital mobility exists, savings and investment are correlated due to changes in exogenous variables that impact on savings and on investment.

According to Taslim (1995) these variables are divided into two groups: a) economic growth and population growth that affect the examined variables in the same direction, and b) systematic intervention by government policies that lead to movement in savings and investment. Another reason why savings and investment are highly correlated in the presence of high capital mobility is the 'country size' effect, where large countries are expected to rely less on foreign funds for investment (Murphy, 1984; Sinn, 1992). Arguments about the impact of the size of the country are found in two versions (Sinn, 1992). The first one links the country size with its impact on world interest rates. If the country is large enough to influence interest rates, increased national savings will reduce world interest rates and boost investment in that country. Savings and investment will be correlated, although there is high capital mobility. The second reason is that as countries become larger their need to borrow from outside is reduced because their investment is financed with domestic funds (Harberger, 1980.)¹. Moreover, the original belief is that the correlation of savings and investment in developing countries will be weaker than in developed countries, since industrial countries have more integrated capital markets and a less regulatory environment than developing countries². This result can be also connected with income level. Countries with high income have a higher β coefficient than those with middle and low incomes. In addition the correlation between savings and investment varies depending on the degree of openness of the economy such that economies that are grossly involved in international trade have a weaker correlation between savings and investment.

3. Review of the theoretical and empirical literature

Regarding the Feldstein - Horioka puzzle, it is important to note that different studies have different understandings of the above conclusions, depending on the sample of countries, the time span of the research and the variables used or econometric methods. The following is an overview and conclusions of the most relevant research on the relationship between domestic investment and savings with an emphasis on CEE countries, i.e. post-transition countries and small open economies with relatively small national gross savings (such countries, if still in the ascending phase of the business cycle can't rely only on domestic savings to finance domestic investments, but also partly on imported savings). Taking into account such a relationship between domestic savings and domestic investments, two scenarios are possible. The first scenario takes into account low correlation of the two key variables, with domestic and foreign savings acting as complements where "imported" savings complement the insufficient domestic savings needed to finance domestic investment, while the second

¹ This can also be connected with "home country bias" meaning that home investors are facing higher transaction costs when borrowing abroad than at home country.

² Payne and Kumazawa (2006) estimated β coefficients for 47 developing countries for the period 1980-2003. Applying a cross-section approach, they found a positive and statistically significant relationship between savings and investment, where β is equal to 0.49 for all 47 countries, but this β is significantly lower than the one estimated for developed countries

scenario assumes a correlation between domestic and foreign savings as a substitutes.

Recent research on the relationship between domestic investment and domestic savings, however, has shown in the last 20-30 years, with increasing financial globalization, a weaker correlation in both developed and growing markets (Ohta, 2016). Giannone and Lenza

(2008) show that the correlation between domestic savings and investment became insignificant for 23 OECD countries between 1970 and 2004. Kumar and Rao (2011) also conclude that the correlation between savings and investment for 13 OECD countries also steadily declines in the 1960 period. - 2007. Misztal (2011) using VAR models in the analysis of savings and investment nexus concludes that there is a higher degree of correlation for growing and developing countries, compared to developed countries. Chang et al. (2014) in the research confirms the existence of two puzzles - a positive ratio of domestic savings and investment in developed and developing countries and a significantly higher correlation between savings and domestic investment in developing countries compared to developed countries. Ohta (2008) in an earlier study concludes that there was a significant correlation between savings and investment in both developing and developed countries in the 1970s and 1980s, but that there has been a gradual weakening of the correlation over the last two decades. The recent global financial crisis has also had an impact. Ketenci (2013) analyzes the relationship between savings and investment in a sample of 26 countries divided into several groups (the whole OECD, EU 15, NAFTA and G7) for the period 1970-2008. Empirical conclusions reveal that the F-H puzzle exists only in the sample of G7 countries. the value of the retention coefficient was estimated between 0.754 and 0.864 (for the entire G7 sample), while in other groups of countries the hypothesis of a significant correlation between savings and investment (except for stable NAFTA countries) was largely rejected. But and Morley (2016) also analyse the impact of the crisis on the F-H puzzle, whereby, based on the selected OECD countries and net capital importing countries, they come to the conclusion that in the period before the financial crisis, the correlation between domestic savings and investments was evident, with this relationship being reinvigorated by the onset and ending of the crisis. In the context of the available research on the relationship between domestic savings and domestic investments, some of the following reasons are most often cited as the reason for the (in)existence of the F-H puzzle: compliance with the intertemporal budgetary constraint, the phase of the business cycle in which the economy of a particular country is at the moment, the targeting of a certain level of current account deficit, the size of the market of a particular country (the larger economy implies a larger internal financial market, where smaller countries have inability to influence the movement of interest rates) and the home bias hypothesis according to which the existence of a high correlation between domestic savings and domestic investments is explained by the existence of frictions on international financial markets. A summary of some significant research on the subject relation on the sample of CEE countries will be presented below.

Petreska and Mojsoska Blaževski (2013) on the sample of Central and Southeast European countries divided into three subsamples (CEE countries, SEE countries and CIS countries) and for the period 1991-2010 confirms the existence of F-H puzzle for all three groups of countries. The value of the coefficient for CEE countries is the

highest and amounts to 0.86, for SEE countries it is 0.58 while for the sample of CIS countries it is the lowest and amounts to 0.47). With the exception of CEE countries for which the zero hypothesis that the retention coefficient is equal to 1 cannot be dismissed, for the other two samples of countries one cannot even be at the level of statistical significance of 10%, with the narrow conclusion imposed by the logic that these two groups of countries still rely for the most part on foreign savings for the purpose of financing domestic investments, i.e. that the declining level of domestic savings will not have the same impact on investment activity in the country (for this reason, domestic investments will not decrease). Three additional variables are also used as control variables: the share of imports and exports to GDP, the annual rate of population growth and the size of the country expressed through the GDP.

Tumanoska, Mojsoska-Blaževski and Petresek (2016), also on the example of Macedonia, test the existence of an F-H puzzle for the time period 1991-2014 by analyzing the time series using Johansen's co-integration. The value of the estimated coefficient is 0.685 and is the same statistically significant, citing the conclusion of the limited but not complete immobility of capital. The size of the estimated coefficient assumes that Macedonia does not have enough of its own savings to finance domestic investments leading to dependence on foreign savings and promoting "aggressive" policies by governments to attract them. Furthermore, Jošić and Jošić (2012) on the example of Croatia using vector autoregression and analyzing the period 1994-2010 come to the conclusion of a strong positive correlation between domestic savings and investments (the value of the coefficient is a high 0.88). Bineau (2014) on the example of Bulgaria as a small open economy explores the relationship between savings and investments for the observed period 1999-2009. By using several tests and applying static panel models with different estimators, the author finds a low value of the retention coefficient, thereby confirming the significant impact of increasing regional capital mobility and trade openness on regional investments (a change in openness by 1 p.p. leads to an increase in regional investments by 0.47 per cent), with greater openness leading to the substitution of domestic investments. Petrovic (2013) explores the existence of a puzzle on the example of Serbia (1997-2010) without finding a co-integration relationship between domestic savings and investments and concludes that there is little link between domestic savings and investments.

In conclusion, as is partly evident from the above research review, the low coefficient of retention of domestic savings can also lead to a higher inflow of foreign capital with the aim of financing domestic investments, where there is also the possibility of crowding out or reducing the level of investment activity in the receiving country. For example, Jude (2015), in its research confirms the short-term effect of crowding out domestic investments, with this effect weakening over time. In the study, the author also takes into account the form in which FDI enters the country, with the effect of crowding out higher in the short term in the case of greenfield investments compared to brownfield FDI, or FDI concentrated on M&A activities. Szkorupova (2015) also analyzes the relationship between domestic and foreign investments on the example of selected post-transit CEE countries, finding the negative impact of foreign foreign investments on domestic investments. The reason for this lies in the privatization effect where foreign companies are pushed out of the market by foreign companies due to the acquisition of domestic firms, better know-how and lower marginal costs.

From the above mentioned, the author draws the following conclusion: the influence of FDI on the contribution to the investment activity of the receiving country depends largely on the sector in which foreign direct investment is undertaken, that is, the impact of FDI will be complementary to domestic investments if invested in a sector that is not technologically developed and lacks know-how about doing business in foreign markets. In the converse case, if there is already domestic competition in a particular activity, additional FDI undertaking into these sectors will lead to the expulsion of domestic companies from the market.

4. Empirical testing of F-H puzzle

In this part of the paper, the relationship between domestic savings (in% of GDP) and gross domestic investment (in% of GDP) will be tested on a sample of 11 CEE countries (Bulgaria, Croatia, Czech Republic, Hungary, Latvia, Lithuania, Estonia, Poland), Romania, Slovakia and Slovenia) for the period 1995-2020. Data for the variables were collected from the World Bank's WDI database. Empirical analysis was carried out using static panel analysis with random effects. A model with a random effect is a simple linear model in which it is assumed that the observation units were selected in a random way. It is also assumed that the differences between the observation units are accidental. The existence of a random effect in the panel model is confirmed using Breusch and Pagan Lagrangian multiplier test for random effects. Using Levin-Lin-Chu unit-root test data for the variables used were tested for the existence of a unit root. At the significance level of 1% for both variables used, the zero hypothesis of the existence of the unit root in the data was rejected.

Prior to the econometric analysis of the impact of domestic savings on investment, the figure below shows the scattergrams with the estimated regression line between the two variables. It can be seen that in the entire sample of countries there is a slightly positive relationship between domestic savings and investment, while in some countries it can be noticed a linear or slightly negative relationship between the two subject variables. Given the results shown below, such results of empirical panel analysis are also expected.

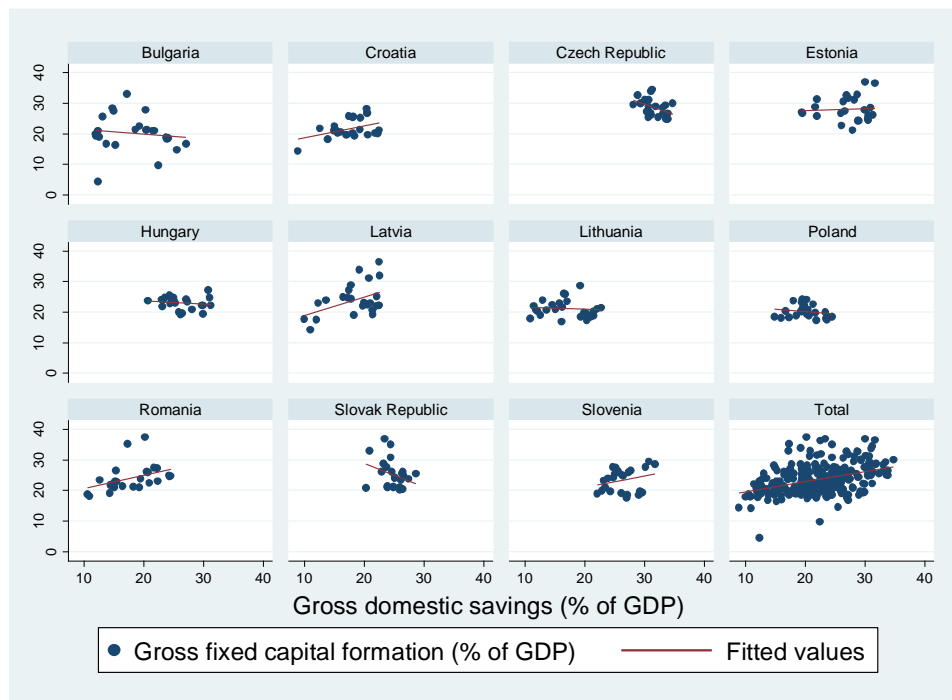


Figure 1 Scattergrams with estimated regression line

Table 1 Results of econometric panel analysis and diagnostic tests

Dependent variable →	Investment
C	19.34486*** (1.528421)
Savings	0.1892987*** (0.0627077)
Number of observations	275
Number of countries	11
R ² (between panels)	0.5695
Breusch and Pagan Lagrangian multiplier test	77.80***
Levin-Lin-Chu unit-root test (savings)	-6.1697***
Levin-Lin-Chu unit-root test (investment)	-8.3863***

*, **, *** indicates statistical significance at the level of 10%, 5% and 1% and the values in parentheses are standard errors

As can be seen in the table above, econometric panel analysis identified a positive and statistically significant impact of the domestic savings on the gross domestic investment. It is important to note that the estimated beta coefficient is relatively small ($\beta = 0.1892987$), which leads to the need to finance domestic investments in part by

imported savings, i.e. based on the analysis it can be concluded that a very low percentage of domestic investments are financed by domestic savings.

5. Conclusion

The paper tested the impact of domestic savings on the financing of domestic investments on the sample of selected 11 CEE countries for the period 1995-2020. Prior to the empirical analysis, data were tested for the existence of the unit root. Furthermore, an empirical panel analysis revealed the positive and statistically significant impact of domestic savings on the financing of domestic investments. The value of the estimated retention coefficient was relatively low, which indicates the need to finance domestic investments by imported savings. It is important to emphasize that the inflow of foreign savings must be directed primarily to those sectors that are export-oriented and will not lead to the crowding out of domestic investment.

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SCIENTIFIC PAPERS

A STRATEGY FRAMEWORK FOR REGIONAL DEVELOPMENT

Timo Becker

University of Applied Sciences Kaiserslautern, Germany
timo.becker@hs-kl.de

Sebastian Kaiser-Jovy

University of Applied Sciences Heilbronn, Germany
sebastian.kaiser-jovy@hs-heilbronn.de

Abstract. Regional development is a multidimensional concept that is determined by many factors. The broad areas of interest are: sustainability and resilience, socio-culture and socio-economy, stakeholder involvement and objectives. This poses a difficult challenge for planning and evaluating activities and measures in regional development. To combine economic and noneconomic factors we propose the integration of existing strategy models into a cohesive strategy framework. This hybrid holistic framework allows the design of a strategy canvas for a practical application in consulting, education, and practice. The framework not only combines the strategic models it integrates them and defines a process of iteration which allows for evaluation and adaptation as well as in planning phase and in realization phase of regional development initiatives.

Key words: *strategy, management, regional development, logic model*

1. Introduction

The sustainable development of regions depends on numerous factors. In addition to political-economic decisions, such as the designation of industrial areas, socio-economic and socio-cultural measures play an important role. These include artistic creation of all kinds, entertainment and sporting events, education, congresses and meetings, community and cross-border cooperation.

It can be complicated and confusing to address each stakeholder individually, such as investors, municipalities, regional governments, corporations, or other interest groups in order to find out what interests and objectives exist and whether goals have been achieved after some time. Furthermore, the respective target dimensions of the individual stakeholders may conflict with each other or change over time. The providers of tourism services, for example, are united in a complex production network of competing companies. While cooperation between competing providers is at most a possible option in other areas of the economy, for destination management, however, it is constitutive: different producers competing for the total revenue must cooperate to create it.

A strategic framework that aims to address the multitude of demands on different levels requires a holistic approach. Therefore, we propose the combination of several strategic models into an integrated strategic canvas.

2. Challenges of Regional Development

To promote any kind of development one must distinguish between areas of interest that are supposed to be developed on one hand and instruments which are being used to initiate such a development on the other hand.

Regional development typically deals with the geography of welfare and its evolution. It is a multidimensional concept with a great socio-economic variety that is determined by many factors such as natural resource endowments, quality and quantity of labor, capital availability and access, productive and overhead investments, entrepreneurial culture and attitude, physical infrastructures, sectoral structure, technological infrastructure and progress, open mind, public support systems, and so forth (Nijkamp, Abreu, 2009/2020).

In summary the broad areas of interest in the case of regional development are: sustainability and resilience, socio-culture and socio-economy, stakeholder involvement and objectives.

Azis (2009/2020) points to the limitations of solely economic approaches in regional development as there are quite a few noneconomic factors. Furthermore, these factors play a vital role in the success of any effort toward a positive development.

„A distinctive feature of a region or any spatial unit is the embeddedness of certain noneconomic factors including the social and cultural relations manifested, among others, in social capital, trust and reciprocity, habits, and norms, all of which have a key role to play in regional development.“ (Azis, 2009/2020: 271)

The distinction between economic and noneconomic factors automatically leads to a diversity in economic and noneconomic objectives. On top of that objectives in regional development tend to be multidimensional as the goals of regional development go beyond mere growth (Azis 2009/2020: 273).

This poses a difficult challenge for planning and evaluating activities and measures in regional development. Most strategic approaches are either solely economically oriented or are not diverse enough in general. Along with these distinctions usually comes a differentiation between quantitative and qualitative indicators to make assumptions about the degree of the achievement of objectives. This paper proposes a strategic framework for the integration of a multitude of economic and noneconomic factors as well as diverse objectives of different stakeholders.

3. Elements of the Strategic Framework

To address the challenges and to accomplish the task of planning and evaluating regional development projects a holistic strategic framework is required. The framework needs to incorporate economic and noneconomic factors reflected in the diverse objectives of different stakeholders. There is no single strategic approach that is capable of such a task. To create a framework of several strategic models a central systematic is required which connects the different elements of the framework. This central element and a very good starting point is the so-called Logic Model. The following content of this chapter presents the elements and systematic of this model as previously illustrated in Becker, Kaiser-Jovy (2021).

3.1 Logic Model

Traditionally, Logic Models have been used primarily in evaluation, particularly in program evaluation of higher education programs, and in project evaluation, especially for projects with a non-profit background (see Johannes et al., 2019; Olson, 2014; Moss, 2012). They support the design, planning, communication and evaluation of programs projects, processes, strategies and measures. They can be used to explain an idea, address a challenge, or evaluate progress. A particular strength of Logic Models is that they clarify the multi-layered relationships between the elements of complex systems. Logic Models are tools that convey a scheme, program or project in a short, visual format. They describe strategies and their expected outcomes, as well as short- and long-term impacts. The process of modeling thereby enables careful consideration of the relationship between activities and outcomes (Wyatt Knowlton, Phillips 2013, 3).

"The process of modeling encourages iterative development of an idea, program, or project. It can create a safe space to start a debate, generate ideas, support deliberations, and allow one to think more clearly about specific relationships. A single, coherent logic reflects a consistent thread that connects design, plans, execution, and evaluation. This thread of evidence-based logic is critical to program and organisational effectiveness. Modeling allows careful consideration of the relationship between activities and results. When tackled by a team or small group of stakeholders, models can be improved by engaging the knowledge and experience of others" (ibid.).

Wyatt Knowlton and Phillips (2013, 28) state that the application of the Logic Model contributes to the quality of design, planning, monitoring and implementation. In addition, it is considered to contribute to the development of a common language among the stakeholders.

The first step in assessing change is to roughly divide it into directly measurable (quantitative, tangible) changes and indirectly observable changes (i.e. usually qualitative, intangible). When assessing changes, we first have to deal with a rough subdivision into directly measurable (quantitative, tangible) changes and indirectly ascertainable changes (i.e. usually qualitative, intangible). If, for example, the goal of a project is to increase the (business) productivity of an organization, the change can very easily be achieved by measuring the output. However, if the goal of a project is to increase customer satisfaction or to improve the image of a brand, then direct measurability is no longer possible. The Logic Model takes into account the problem of different qualities of results by not only considering outputs as results, but also including the categories outcome and impact. According to Wyatt Knowlton and Philips (2013, 37), determining desired results is the first step towards effectiveness. Models start with results. Results consist of outcomes and impacts. While impact is the ultimate goal, sometimes synonymous with a vision, outcomes are earlier indications of progress towards achieving a certain goal.

Savaya and Waysman (2005, 86) take up the idea that every program has a theory (program theory in the sense of an assumption) of how it should work or what change it should bring about. The Logic Model is the (schematic) representation of this assumption through a comprehensible and consistent argumentation (fig. 1). This argumentation explains the logic of the project (program logic). The program theory

thus sets out the assumptions that apply in relation to the transformative mechanisms that are seen to be effective in creating change and growth.

These mechanisms emerge in the connections between the elements of the Logic Model. They are briefly explained below. There is no consensus in the literature on the exact naming of the individual elements. Traditionally, the elements input, output and outcome are used. In the case of the outcome element, a distinction is usually made between short-, medium- and long-term outcomes. In more recent publications, the element activities is added, which represents an extension or differentiation of the element input, since activities are also something that one brings into a project. Furthermore, the element impact is added, thus taking into account the fact that projects can have effects beyond outcomes (cf. McLaughlin & Jordan 1999; Savaya & Waysman 2005; Wyatt Knowlton & Philips 2013; McLaughlin & Jordan 2010).

The **input** category describes the resources that are brought into a program or project. Assessing the effectiveness of a project is facilitated if the planned inputs are adequately and comprehensively described. The ongoing comparison of planned and actual investments enables accurate assessment and evaluation to improve future projects, justify budgets and set priorities. The detailed description offers the possibility to communicate the special quality of a program or initiative. Inputs include:

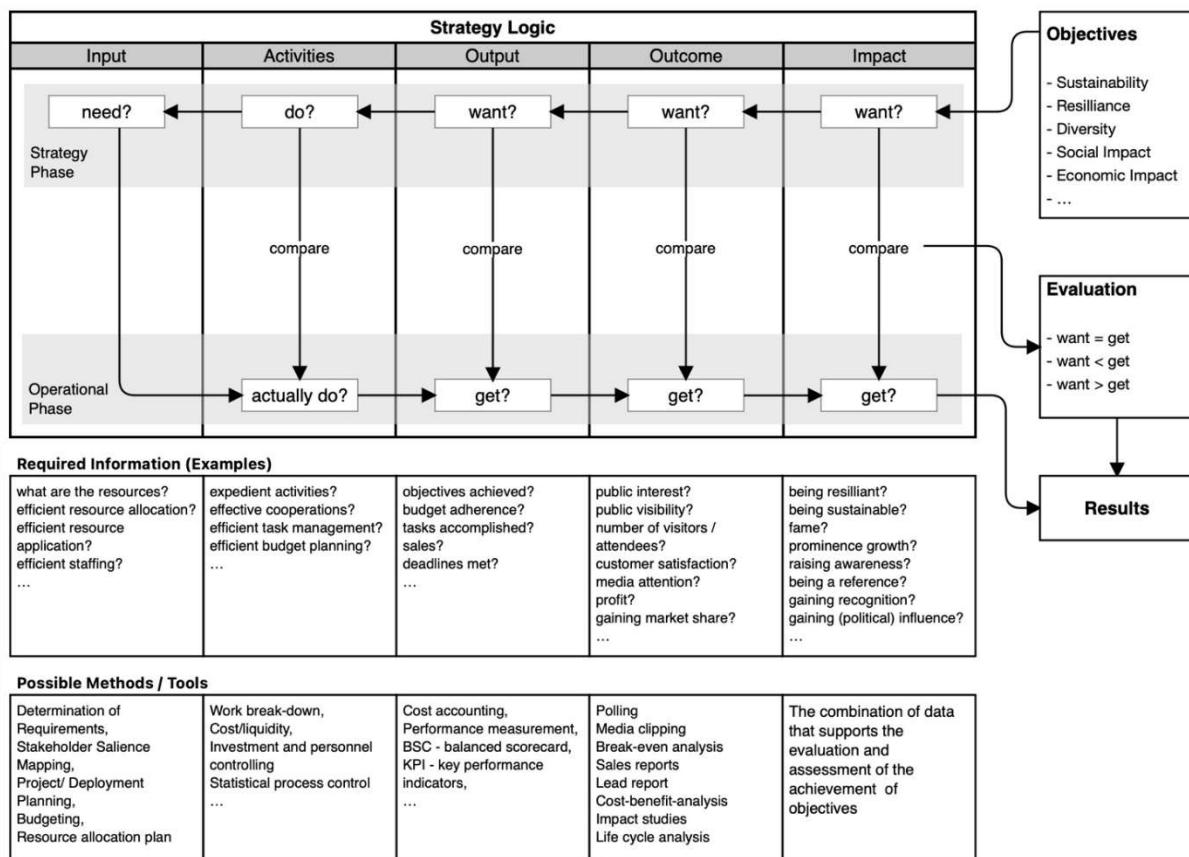


Figure 1 Logic Model

- Experience and skills/expertise of people involved,

- Staff, volunteers, partners, local people and involvement of local, state, national authorities and organizations involved in planning, implementation and evaluation,
- Public/fiscal resources, including earmarked funds, special grants, donations and user fees, licensing/rights revenues,
- physical resources, such as infrastructure, facilities and equipment.

The **activities** element is an extension of the Input element. Here, the procedural aspects are addressed. These aspects are usually directly linked to resources. They include planning and administrative activities, implementation of sub-projects and orders to external service providers, cooperation partners and suppliers, etc. Activities include all work packages that are necessary to achieve the planned output.

The **output** element describes those aspects that are a direct result of activities, e.g. the provision of products, goods and services to customers and the people reached (informed consumers, knowledgeable producers). The description of outputs enables links to be made between the problem (situation) and the effect of the program (intended results). Outputs include:

All types of measurable outputs,

number of visitors/participants, satisfaction, etc.,

Publications such as articles, bulletins, manuals, websites, media presence,

Discovery and application activities such as research, demonstrations and product trials.

The **outcome** element answers the question: "What happened as a result of the program? As a rule, events have several successive and interrelated results, which can be summarized as a result structure. A distinction should be made between changes that are closely related to or directly caused by the initiative in question, intermediate outcomes that are expected to result from the short-term outcomes, and long-term outcomes or impacts. These effects are given their own category, impact, in extended forms of the Logic Model.

The term **impact** is often used to describe an effect, or long-term effect. Impacts in the sense of the Logic Model are profound and long-term effects of a project, program or initiative, which as intangible effects can often only be measured indirectly (if at all) and whose evaluation leaves a lot of room for interpretation, especially since the future-related nature and the complexity of their impact relationships make it difficult to name causalities. Last but not least, they often affect individual population groups or stakeholders in different ways. It is true that development programs or projects appear increasingly worthy of support from the perspective of the public sector as the range of effects and their impacts (in the sense of positive external effects) increases (keyword: public goods, Samuelson 1954). Possible positive impacts are image improvements of an institution, city and/or region through the creation of a sense of belonging among the regional population, the consolidation or change of attitudes of groups of people towards a topic, integration/inclusion effects, and many more. Planned impacts refer to these lasting, sustainable effects, which is why they also offer the central starting point for sustainability goals. These include fundamental social welfare aspects, such as those laid down in the "Agenda 2030" of the international community of states like health and well-being, quality education, gender equality, etc. The Sustainable Development Goals (SDGs), or global targets, comprise a total of 17

interconnected global goals that are intended to serve as a blueprint for a better and more sustainable future for all humanity. In 2015, the SDGs were established by the United Nations General Assembly (UNGA) and are to be achieved by 2030.

If we consider the Logic Model as a tool of strategic management, which encompasses both the (argumentation) logic of a project and the logic of a change process, then we should, as described at the beginning, choose the identification of objectives as the starting point for strategic planning process. In strategic planning it is typically assumed that the application of certain strategies will lead to predictable or desirable results. The relationship between a strategy and a particular outcome is usually assumed and plausibility is fed by three sources: Theories, research findings and experience. Wyatt Knowlton and Phillips (2013, 52) accordingly outline the process of building a Logic Model as beginning with the identification of desirable results. Even this first step can pose a significant challenge, as different stakeholders and interest groups may have very different requirements for a project. The comprehensive involvement of all relevant stakeholders ("stakeholder salience") is particularly important. "Stakeholder participation is [...] a decisive moment in creating acceptance" (Thimm 2014, 51). The next step is to name the strategies whose implementation is expected to ensure the desired results. This process is highly charged with assumptions about how certain strategies will work. It is a particularly salient feature of the Logic Model that these assumptions are not implicitly assumed, but are highlighted in order to subject them to discussion. This is to ensure that the logic (plausibility) of the project does not contain any breaches and that the assumed relationships between the elements (input, activities, output, outcome, impact) are comprehensible. The modeling process can be thought of as a review process that takes place before implementation or execution. It serves to improve thinking and the models that reflect it. It also provides an opportunity to engage in dialogue at an early stage and, last but not least, guides model improvement.

3.2 Analysing the Environment

One of the most commonly used analytical tools for assessing external factors is **PESTEL** analysis. PESTEL is an acronym for *Political, Economic, Social, Technological, Ecologic and Legal*. These are the six dimensions the broader environment of an organization is composed of. PESTEL analysis mainly provides a general idea about the macro environment and situation of a company (Yüksel, 2012). The organization needs to gather the information required to understand each dimension and its implications for the selection and implementation of the appropriate strategies.

According to Witcher (2020) PESTEL is the most comprehensive and most used approach for grouping and reviewing macro-environmental trends in strategic management. It is important to use it as an integrated, not compartmentalized view of trends and changes.

Political factors include trends in not only the actions of local, national, and international governments and agencies but also the thinking and activities of influential groups and individuals. Competition in many areas is shaped by government policies and regulatory decisions. Typical questions to ask in this context are: How

stable is the political environment? What are local taxation policies? What are the social welfare policies and labor laws?

Economic trends include resource use and prices, interest rates, disposal income, economic growth, inflation, and productivity. Further typical questions are: What is the level of inflation? What are exchange rates between critical markets? What are local employment levels per capita and how are they changing?

Social factors include demographic, social and lifestyle trends, group identities and gender roles, national cultures, ethics, morality, and expectations. Furthermore, the following questions might be relevant: What is the level and distribution of education and income? What are the dominant local religions and what influence do they have on consumer attitudes and opinions? What is the level of consumerism and popular attitudes toward it? What are the attitudes toward work and leisure?

Technology includes the impact of new and developing technological change on resources, products and services, and operations. Further interesting questions are: What is the level of research funding in government and the industry, and are those levels changing? How mature is the technology? What is the status of intellectual property issues in the local environment? How fast is technology changing? What role does technology play in competitive advantage?

Environmental factors include not only quality of life, sustainability, and recycling of resources but also logistical possibilities and infrastructure. Issues such as world resources, global warming, and pollution are intensifying and will have to be taken into account by most organizations. Typical questions are: What are local environmental issues? How do the activities of international pressure groups affect your business? Are there environmental protection laws? What are the regulations regarding waste disposal and energy consumption?

Legal factors include laws and regulatory action, standards, border requirements, labor regulations, and so on. This may also include globalization issues dealing with international trade and competition law. National legal frameworks vary considerably, and their consequences for individual industries are profound. One of the most significant trends is the tightening of regulatory accounting standards following large corporate failures. On top of that questions revolving around status of employment, health and safety, and product safety laws are relevant.

To illustrate the composition and connections of the dimensions of a PESTEL analysis it appears reasonable to create a **cluster analysis**. Cogan Wares (2008 / Porter 2000) points out that Clusters are geographic concentrations of interconnected companies, with linkages to related organizations such as trade associations, government agencies, and research and educational institutions. Related economic activity tends to agglomerate naturally for a variety of reasons, such as the presence of unique natural resources, proximity to markets and reduced transaction costs. She continues to explain that the existence of clusters is well accepted, but the ability to influence their formation and growth through purposeful action remains controversial. Boja (2011) complements that statement by noticing that although there are globally recognized clusters examples such as Hollywood or Bollywood in film industry, wine industry in California, information technology in Silicon Valley and Boston, economic research must provide models that can be applied to a lower regional level so that economy policy makers can identify or help start clusters initiatives. Porter (2000) adds

that the geographic scope of clusters ranges from a region, a state, or even a single city to span nearby or neighboring countries.

An additional approach to characterize the connections of an organization's environment is **network analysis**. Clusters may suffer from information gaps that hinder their potential. Cluster initiatives provide information and research to educate firms and other internal stakeholders about opportunities and priorities for shared action (Donahue et al. 2018). It seems appropriate to use the information gathered by the PESTEL and cluster analysis and fit it into a (social) network analysis. Cross and Prusak (2002) explain the concept which puts every entity in a social network in one of four categories:

Central connectors, who link most people in an informal network with one another.

Boundary spanners, who connect an informal network with other parts of an organization or with similar networks in other organizations.

Information brokers keep the different subgroups in an informal network together.

Peripheral specialists, who anyone in an informal network can turn to for specialized expertise.

The network itself can then be categorized as one of three different types as suggested by Ibarra and Hunter (2007):

Operational Networks, where contacts are oriented toward current demands to benefit from each other's expertise.

Personal Networks, where contacts are oriented towards current interests and future potentials.

Strategic Networks, where contacts are oriented toward the future for creating leverage for inside-outside links.

The Information gathered in this section of the strategy framework is transferred through the stakeholder analysis into the logic model. The contacts will there be viewed under the lens of a stakeholder approach.

3.3 Stakeholder Involvement

How broadly to define the scope of stakeholders has been among the more persistent questions for stakeholder theory. A case can be made that the concept of an objective function is inextricably intertwined with the question of "for whose benefit and at whose expense should the firm be managed?" (Phillips et al. 2019). According to Franklin (2020) stakeholders can include clients, partners, competitors, interest groups, and the public. However, stakeholders are only able to interact with an organization when human beings represent them, irrespective of whether they are representing themselves or acting as a representative for an institution.

Stakeholders are not a homogeneous group. There are different types of stakeholders. The roughest distinction may be the one between internal and external stakeholders. Referring to people within the organization and those outside. However, when it comes to initiatives and/or public institutions it is not always clear which one is an internal or external stakeholder.

On top of that stakeholders can be of benefit to an organization on one hand and have demands toward the organization on the other hand. In both cases they contribute to

the objectives of an organization or initiative. Collecting, understanding and categorizing stakeholder objectives is the starting point for every endeavor. To create a compelling overview of stakeholder objectives, the goal is to foster a marketplace of ideas and to systematically gather preference data for decisions. For some decisions, stakeholder input is binding; for other decisions, stakeholder input is advisory (Franklin 2020). Franklin (2020) even proposes a specialized hybrid stakeholder engagement logic model.

When it comes to regional development stakeholder involvement plays a key role, as communities consist of a multitude of institutions, organizations and interest groups. Mapping those stakeholders and identifying their interests and possibly their individual objectives toward development measures and initiatives is at the center of any endeavor toward a regional development. A Logic Model that is properly equipped with carefully categorized stakeholder objectives is far more likely to succeed.

3.4 Business Model Canvas

The business model canvas is a well-established strategy tool. A business model describes the rationale of how an organization creates, delivers, and captures value (Osterwalder, Pigneur 2010). The canvas designed by Osterwalder and Pigneur consists of nine building blocks and is a very fitting addition to the other strategic concepts combined in this framework. All the models introduced in the framework are canvas-like concepts, which makes it easy to connect them. The business model canvas itself contains building blocks (key activities and key resources) that correspond deeply with the Logic Model (inputs and activities) at the core of the framework. On top of that the key partnership building block corresponds strongly with the stakeholder approach. Hereafter the nine building blocks will briefly be described.

The Customer Segments Building Block defines the different groups of people or organizations an enterprise aims to reach and serve.

The Value Propositions Building Block describes the bundle of products and services that create value for a specific customer segment.

The Channels Building Block describes how a company communicates with and reaches its Customer Segments to deliver a value proposition.

The Customer Relationships Building Block describes the types of relationships a company establishes with specific customer segments.

The Revenue Streams Building Block represents the cash a company generates from each customer segment.

The Key Resources Building Block describes the most important assets required to make a business model work.

The Key Activities Building Block describes the most important things a company must do to make its business model work.

The Key Partnerships Building Block describes the network of suppliers and partners that make the business model work.

The Cost Structure describes all costs incurred to operate a business model. (Osterwalder, Pigneur 2010)

In summary, the business model canvas provides a resourceful addition for detailing the narrative of the logic model by extending the categories and providing answers to some of the most precious questions among several groups of stakeholders.

3.5 Analysing the Organization

To provide a multi-perspective analysis of an organization there is hardly a more compelling model than the four frame model by Bolman and Deal (2008). Frames serve multiple functions. They are filters for sorting essence from trivia, and tools for solving problems. The structural approach focuses on the architecture of the organization.

The Structural Frame analyzes the design of units and subunits, rules and roles, goals and policies.

The Human Resource Frame emphasizes understanding people, their strengths and foibles, reason and emotion, desires and fears.

The Political Frame sees organizations as competitive arenas of scarce resources, competing interests, and struggles for power and advantage.

The Symbolic Frame focuses on issues of meaning and faith. It puts ritual, ceremony, story, play, and culture at the heart of organizational life.

(Bolman, Deal 2008)

The most important contributions of the four-frame-analysis to the strategy canvas is the definition of internal stakeholders and the organizational environment out of which they operate. A key aspect of these contributions are assumptions about how decisions are being made in the context of the organization. That leads to an understanding of how the objectives of the internal stakeholders are being forged.

4. Connecting the Elements of the Framework and Creating a Strategy Canvas

The Logic Model itself describes a process of planning and evaluation starting with stakeholder objectives defining results in the different stages (output / outcome / impact) and comparing them with actual results during the course of an endeavor. That shows that the Logic Model is strongly interconnected internally.

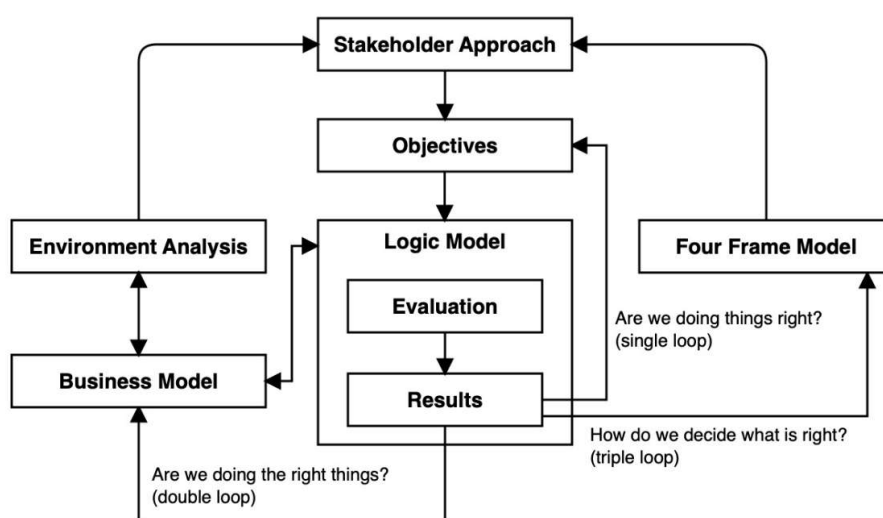


Figure 2 Holistic Strategy Framework

When it comes to connecting the Logic Model with the other elements of the framework (fig. 2), there is a clear link between the stakeholder approach and the objectives section of the Logic Model. The ultimate source for identifying, assessing, and integrating objectives is the stakeholder map.

However, the information of the stakeholder map is being gathered from at least two different sources: The analysis of the external environment consisting of the PESTEL model, the cluster analysis and the network analysis. The analysis of the organizational environment is created within a four-frame model. The analysis of the external environment has a strong link to the business model canvas. The description of the business model is a key information of how an organization wants to act within the environment. The two elements strongly inform each other, especially when it comes to customer segments, key partners, resources, etc. The business model itself overlaps with the Logic Model as they share the analysis of inputs / key resources and (key) activities.

To create a really interdependent iterative model it is necessary to close the loops left open by the notion that it could be enough to just feed information into the Logic Model. This is achieved by applying the triple loop learning systematic to the strategy framework. The triple-loop-learning model is based on the work by Argyris and Schön (1996).

In the single loop learning there is a comparison of the results with the strategy, tools, and tactics that supposedly led to those results. The basic question here is: Are we doing the things right? The double loop takes a wider approach and integrates the underlying assumptions that led to the strategy. In this case the basic question is: Are we doing the right things? And finally, in the triple loop the context is integrated, by considering values, culture, mission etc. This shifts the basic question to: How do we decide what is right?

Within the strategy framework these connections are easy to identify. The single loop iterates back into the Logic Model and the tools used to plan and evaluate every stage of the model. Have these tools proven to be the right instruments to achieve the intended results? The double loop iterates back to the business model because this is where the underlying assumptions about the functionality are located. Especially in the building blocks concerning the customer segments, customer relation, distribution channels and consequently the revenue. The triple loop connects the results with analysis of the organizational environment because that is where the question can be answered: how do we decide what is right? The four frame model extensively provides information about values, structure, culture, needs, roles, rules, relationships, conflicts, etc. This can ultimately answer the question how the organization makes decisions, especially the process of how objectives are formulated by the internal key stakeholders.

Environment						Stakeholder		Organization					
Political	Economic	Social	Techno-logical	Environ-mental	Legal	external	internal						
Networks / Clusters						Objectives							
Business Model													
Strategic Partners	Activities	Value Proposition		Customer Relation	Customer Segments	Output	Outcome	Impact	Structure	Human Resources	Politics	Sym-bols	
	Resources			Distribution Channels									
Cost			Revenue										
Evaluation													
Results													

Table 1 Strategy Canvas

As all of the models integrated in the strategy framework are more or less illustrated as canvases by their respective inventors, it appears only logical to combine these into an integrated holistic strategy canvas. This canvas serves as tool to illustrate key information and the program/project logic to stakeholders.

5. Conclusion

The purpose of this article is to provide a tool that tackles the challenges of regional development initiatives. In regional development a multitude of objectives (neutral, complementary or event conflicting) formulated by a diverse range of stakeholders need to be categorized and integrated. The first and most obvious distinction is between economic and noneconomic objectives. But it does not end there. It is also important that the targeted results are being identified as either outputs, outcomes, or impacts. This classification may take some thought and every classification in a more abstract level requires a follow up in a lower level of abstraction. Meaning, every Impact requires certain outcomes, every outcome requires certain outputs, every output requires certain activities and all together there is range of inputs required to achieve any of it. That is why the strategy forming process always starts with the objectives and the basic question: what do we want? However, not every stakeholder's objective is automatically in the impact category. That is why these objectives need to be put into the most fitting category. There it might be necessary to define what needs to be achieved in order to get there, but also what effect it might have on a higher category. The process of adjusting the connections between the categories of the Logic Model goes back and forth until they are coherently aligned. That process takes a large amount of information gathering and analysis.

By combining several strategy models which all provide a noteworthy amount of information into a homogenous interconnected framework centered on a Logic Model, it is possible to deal with the multitude and diversity of objectives and still keep an overview.

As important it is to tackle the diversity and to deal with a large group of stakeholders there also needs to be a high degree of comprehensibility throughout a logical argumentation. We believe that those are the central benefits of this holistic strategy framework. Furthermore, the illustration of key information in a strategy canvas provides practitioners with a powerful tool to plan, discuss and evaluate development initiatives.

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THE GLOBAL CRISIS AS A CHANCE: TURNING CHALLENGES INTO OPPORTUNITIES

Senka Borovac Zekan

University Department of Professional Studies, Split, Croatia
sborovac@oss.unist.hr

Mario Dadić

University Department of Professional Studies, Split, Croatia
mdadic@oss.unist.hr

Ivana Tomić

University Department of Professional Studies, Split, Croatia
itomic@oss.unist.hr

Abstract. A crisis is a period of business in which a problematic turning point is marked and is most related to the need for crucial decisions and changes. Crisis management is emerging as a critical factor in the crisis management process. A crisis occurs quickly: in some cases, it can be predicted and in most of them, however, it cannot. The critical task of crisis management is to devise a plan as soon as possible and start acting through the stages of recovery from the crisis. Today, in contemporary society, crises take on a whole new form. These are no longer typical local ones, but they seem to turn into global crises. Crisis management must adapt to emerging situations in its response to issues that transcend regional boundaries. Therefore, an essential step in this process is establishing a correlation between the firm's external and internal crisis factors. The paper uses the case study method to analyse the success of certain companies in times of crisis. Fast and successful adaptation to the new situation seemed to be crucial. During the crisis, the emphasis is placed on internal and external communication. Many crisis managers have succeeded in overcoming the crisis since they have perceived it as a business opportunity. They have grown by raising business to a more efficient and practical level and by making critical changes at the right time. Most importantly, they have gained important information that will serve them in future crises.

Keywords: *crisis management, challenges, opportunities, globalization*

1. Introduction

Crises in companies occur due to various internal and external factors that affect their business. Some of the potential causes of the crisis are inadequate financial and cost management, the negative impact of business on the environment, various market-related causes, such as its position, competition and relations with suppliers, the political and legal environment, and various natural disasters, such as earthquakes, floods, fires et al., which cannot be controlled by the management of the enterprise (Headey, D., & Fan, S. (2008). However, there are situations that can be controlled. This is exactly the key task of crisis management: to lead the company successfully out of a crisis, reposition itself in the market and use the experience gained against any possible recurrence of a crisis in the future. Furthermore, a crisis in a company may also mean an opportunity to improve business and increase employee motivation. This paper aims to explain the main concepts of crisis management and business crisis. Furthermore, the theory application method has been used to establish how

some crises can be perceived as an opportunity to increase business volume, and thus increase revenue, the number of employees and general opportunities for growth and development. This would not have been possible if the company had not been through a crisis and successfully "defended" itself against it.

2. Crisis Management

Crisis management is a set of functions or processes aimed at studying, identifying, and anticipating all potential crises and establishing the necessary ways to enable a company to either prevent a crisis or respond effectively to it (Jaquez, T., 2009). It is also aimed at minimizing the consequences of crises to ensure successful resolutions and, consequently, a return to a normal situation within a short period of time. Crisis management can also be defined as an activity aimed at overcoming a situation that threatens the company's survival and planning and implementing measures that ensure the achievement of fundamental goals (Duchek, S., 2020). Crisis management is marked by strengthening the methods and means needed to manage the crisis and by the introduction of extreme measures of business turnaround. As for the term crisis prevention, preventive or anticipatory crisis management is considered. On the other hand, actions aimed at providing essential, existential variables after the crisis, accompanied by clearly set goals, such as achieving a certain income, are defined by reactive crisis management. Crisis management should be an integral part of any responsible corporate governance in which many business decisions are subject to risk assessments and in which various crises cannot be ruled out. In the same manner as management in general, crisis management is also a type of applied management that is not an exact science but a theory-driven practice. There are numerous definitions of crisis management and Gilbert and Lauren (1980) define it as the ability of an organization to act quickly, efficiently, and effectively in situations aimed at reducing threats to human health and safety, reducing damage to either public or corporate assets, and reducing the negative impact on the continuation of further business. Similar definitions can be found by other authors (Khodarahmi, E. 2009; Koster, M. C., & Politis-Norton, H., 2004) who equate crisis management with addressing unpredictable situations. While these approaches may seem satisfactory when identifying a crisis, they may be ineffective as they do not consider other important aspects of an integrated crisis management plan. It is crucial to design procedures and decisions (Gourlay, C., 2004) that can affect the development of the crisis, and they include the organization, preparation, various measures, and allocation of resources to overcome it. Crisis management usually takes place under pressure (Heath, R., 1998) from the public and the media in stressful circumstances characterized by a lack of accurate information. In conclusion, it can be pointed out that crisis management is a collective name for all types of activities aimed at dealing with situations of disorder, whether it is prevention, preparation, mitigation, or recovery.

2.1. Specifics of crisis management

The specificity of crisis management is that the crisis in the company usually, although it is not the rule, occurs unexpectedly and quickly. When a crisis arises, the management of either a particular company or management, in general, are faced with numerous tasks that are not part of the standard way of doing business and often lack experience in situations that bear the same name. Crisis response measures must be

adopted and implemented in a short time, but this is often not the case (Janssen, M., & Van der Voort, H., 2020). There are many reasons for this and one of the most common is that the existing work plans, which now need to be adjusted, if not completely changed, do not correspond to the new crisis. Much new information arrives in the company that needs to be processed and analysed, and new tasks appear for both the employees and the management, which can lead to the so-called "burnout" of the workforce. In addition, there is a clear danger of both general panic in the company and a hostile business climate. Employees who most often and most quickly succumb to panic are lower-level managers (Reitzig, M., & Maciejovsky, B, 2015) who find themselves in an unexpected situation, without any guidance from superiors, and often have a misconception about the overall situation. They are, thus, prone to reckless thinking and panic, which results in hasty decisions that can be extremely harmful. The main characteristics of crises are the lack of reliable, verified information that can contribute to the process of making crucial business decisions. They are also described by a lack of a solid structure, unpredictability, and inexperience. In addition, crisis managers often must deal with media headlines and various rumours that put them in an even more difficult position when making decisions. In such situations it is essential not to give in to the environmental pressure, either internal or external and make the right decisions that can ultimately mean a successful exit from the crisis and the achievement of corporate goals.

2.2. Overcoming the crisis

Stages of a successful process of overcoming the crisis:

The first stage is just acknowledging the problem. It is done by comparing business performance measurements, analysing, and diagnosing internal strengths and weaknesses and external opportunities and threats, or in other words, by conducting a SWOT analysis. In this way, several important factors are determined: the current state of the company, the possibility and scope of changes and the new opportunities and threats that lie outside the company.

The second stage is the phase in which crisis management is defined. The most critical step in crisis management is defining the right crisis manager. He or she must be authoritative, reliable, and transparent. He or she should be able to set standards and communicate with all persons at a very high level in the process of crisis resolution. A crisis manager must also be a leader who is willing to take even the most significant risks. High standards of productivity and intolerance of inefficient and poor workers are the key tasks. For these reasons, a crisis manager cannot be a randomly selected individual: it must be a person with exceptional experience and abilities who can address all the difficulties that will arise during the crisis.

The third stage is taking control. The first 90-120 days are crucial for establishing control over the crisis and charting a way out of it. There are three steps to taking control. First, the new manager must initially shock the system with risky and courageous decisions to reduce the impact of the crisis. Such moves can negatively affect the existing staff who are not ready for change, and, in that case, they become redundant and must leave the company. The second step is the implementation of orders to strengthen control, work processes in the company's management and the best possible delegation of authority and responsibility. The last step is the attack

phase. The crisis manager evaluates employees and uses their abilities to improve profitability and gather all information to define more clearly the new situation and the company's situation.

The fourth stage, i.e., the evaluation phase, is the phase in which a complete sustainability analysis is performed, where the available financial and human resources and market position are evaluated according to the principles of segmentation. In addition, the present and future of the business must be considered, the balance sheet, profit and loss account established, and a new plan established to enable the company to make a profit.

After four stages of planning, there are three operational phases, i.e., phases of action.

The fifth stage is solving urgent problems in which assets that do not make much profit are abandoned and sold and money is directed to sectors that contribute to profit—suspension of all types of procurement and payments to achieve complete control of financial resources. The primary goal is also the immediate collection of receivables from customers, even at the risk of reducing the volume of business. Change the strategy of negotiating with suppliers, provide liquidity, reduce the number of employees, and make radical changes, if necessary.

The second operational stage, i.e., the sixth in a series of successful exits from the crisis, is the stabilization stage. It requires staff restructuring, empowerment and responsibilities, setting new, more explicit goals, introducing new business standards, and creating a new system of salaries and incentives.

The last - the seventh stage of this long-term process is the phase of return to growth. At this stage, there is an investment in marketing, technology, new knowledge, employee education, quality is brought to a level above the level of competition, and there is market differentiation. A decentralized human resources management system is created, market access is improved, and the emerging market's current state is analysed. When the realization of solvency, growth of market share and growth of efficiency is determined, it can be concluded that the crisis has finally passed. However, after the crisis comes the time for an even greater effort that must be made to continue and improve the business of well-established new systems.

3. Case Studies

The global COVID-19 pandemic was by far one of the biggest challenges most companies have ever had to face. The long-term impact of the pandemic on the economy has yet to be fully revealed, and some businesses have unfortunately failed due to high business pressures. However, despite the various disasters and devastation, the global economy faces, a wave of creativity, innovation and adaptability has grown in many companies operating in different economic sectors. We present six case studies where the COVID-19 pandemic has had a positive impact on the company's operations:

- accelerating the process of transition to "digital" business
- providing companies with opportunities for innovation
- focusing on the importance of staff training and development
- increasing productivity levels
- saving on office operating costs and staff travel costs
- strengthening the sense of community

3.1. Bolt

Bolt is an Estonian mobility company that offers its customers rides through cooperation with partners and food delivery through the Bolt Food application. It was founded in 2013 by nineteen-year-old Marcus Villig. The company currently operates in 45 countries, and in more than 300 cities. In the last year, the company's business has had extremely high growth, which has also been influenced by the number of users. Europe's first mobile application brings together 75 million users worldwide and enables them to use a variety of services: riding on demand, car sharing, and renting an electric bike or scooter. In addition to transportation services, Bolt also offers the Bolt Foodservice - food and beverage delivery service from the restaurant and a novelty specific to the Bolt Market - grocery delivery service within 15 minutes. Bolt is currently the leader in ride-hailing in Croatia and its services are provided monthly by thousands of drivers across the country. The number of users of Bolt applications continues to grow at the Croatian level, the increase in July was as much as 87% and the number of rides performed in the first seven months of 2021 increased by as much as 68% compared to the same period in 2020³. In addition to the ride-hailing segment, Bolt in Croatia is recording good business results by renting scooters and food delivery. A total of 550 Bolt electric scooters operate through Croatian cities - Varaždin, Rijeka and Osijek, through which a total of more than 430,000 kilometres have been covered. On the other hand, Bolt Food in Croatia grew by 97% from January to June 2021: this year in June, there were 34 times more orders than in June 2020. Bolt will present the new 15-minute grocery delivery service through the Bolt Market domain in 10 European countries in the next few months. New markets include

3.2. Glovo

Glovo is a Spanish start-up and development company that started operating in 2015 in Barcelona, today, it is one of the world's leading platforms for the delivery of various product categories. The Glovo application connects users to restaurants, supermarket chains and retail stores and has a significant 'anything' category that allows users to order whatever they want. Since its inception, it has expanded to 105 cities in 20 countries across Europe, Africa and Central and South America, and the number of users has risen to more than 10 million. In the two years of operating in the Croatian market, Glovo has delivered more than nine million products. It is currently present in fourteen cities and every other person in those cities has downloaded the Glovo application. Food orders using the Glovo application have increased by more than 500% since the coronavirus pandemic in Croatia compared to before the pandemic⁴. Growth was expected at that stage of development. However, the fact is that the pandemic contributed to such high results. In addition, Glove's revenue grew by as much as 500% in 2020 compared to 2019. Globally, in the twenty markets in which it operates, Glovo has a strong base of more than ten million users and an excellent partner network. In addition, the technology company recently secured an investment worth 450 million euros, which will be used to develop the Q-commerce department and expand the unique multi-category offer in all markets in which it operates. On July

³ <https://profitiraj.hr/bolt-prikupio-600-milijuna-eura-investicija/> (30.07.2021.)

⁴ <https://lider.media/poslovn-scena/hrvatska/pauza-je-i-sluzbeno-postala-glovo-137524> (30.07.2021.)

1, 2021, it was announced that Pause, also a food delivery application, had been purchased by Glovo, which speaks volumes about the strength and success of this young company, which will undoubtedly continue in the future.

3.3. Dynamic Parcel Distribution - DPD

The global COVID-19 crisis has triggered a sharp increase in package deliveries. DPD's second-largest package delivery network in Europe delivered 1.9 billion packages worldwide in 2020, an increase of half a billion packages compared to 2019. DPD Croatia left last year, with an increase in the volume of packages by 40% compared to 2019, which saw an increase in the number of packages in domestic traffic of as much as 50%⁵. The closure of physical outlets in many countries, self-isolation measures and preventive measures have spurred a sharp increase in deliveries. The pandemic has also accelerated the development of trends whose introduction was not expected until 2024. Therefore, the demand for urban logistics and a sense of responsibility for the environment has already increased significantly. The market is also noticing a significant shift in the delivery of packages to end-users (B2C - Business to customer), the share of such packages within the DPD group is 55%, and in Croatia 75%, which is an increase of an incredible 95% compared to 2019.

3.4. Jadran Galenski Laboratory – JGL

Last year, the Rijeka pharmaceutical company JGL Group, with double-digit growth, generated HRK 1,02 billion in total revenues and thus won the title of the largest Croatian pharmaceutical company. Mislav Vučić⁶, Chief Executive Officer of JGL, points out that crossing the limit of one billion kunas of total revenues has placed them in the group of the largest manufacturing companies in Croatia in the year in which they celebrate 30 years of the company's existence and ten years of one of the most successful brands. " Growth was achieved in all three therapeutic areas - influenza and colds, ophthalmology, and dermatology. According to shares in net sales, Russia is still their largest market with 39% share, followed by B2B business and Croatia. Ivo Usmiani, the President of the Management Board, announces new investments and claims that JGL is becoming a global brand that wants to compete with the largest companies. HRK 670 million of operating revenues in the core business were generated on export markets, which is 85% of exports in the sales structure. In 2021, they will continue with investments, and the most significant project is Integra, worth HRK 373 million.

3.5. Popcorn factory Zagreb - PopUp

Marijan Babić designed a great project during the spring isolation (lockdown). Then, in May 2019, during the COVID-19 crisis, he conceptualized the idea of the first Zagreb popcorn factory. Its realization started immediately and in just over a month, after the launch of the PopUp Corn project, 30,000 bags of popcorn at the plant located in Bregana were produced. Founder Marijan Babić wanted to offer customers a product

⁵ <https://www.poslovni.hr/domace/pokazuju-otpornost-i-fleksibilnost-obaraju-rekorde-nevjerojatnim-brojkama-4280102> (30.07.2021.)

⁶ <https://www.poslovni.hr/domace/rekordni-prihodi-jgl-a-sad-je-nasa-najveca-farmaceutska-kompanija-4275598> (30.07.2021.)

that was delicious and made from proven ingredients without preservatives and unnecessary additives, and, at the same time, of Croatian origin. The PopUp popcorn factory in Zagreb has started to produce eight interesting flavours: sea salt, butter, Mediterranean spices, caramel, white and dark chocolate, fruit, cheese, and chilli⁷. The products are intended for sale in stores, gas stations, and kiosks, but also in the virtual store of Tvornica kokica Zagreb, where, in addition to ready-made popcorn and popcorn in grain, which are offered in several types that our market does not offer, they also offer packages for „the new normal “. Thus, customers can find the Moviebox package among the packages, consisting of a salty range of available flavours, perfect for a movie at home with the family. On the other hand, the Game box package is for those who prefer only the taste of butter and salt. However, this is not the end of the popcorn factory’s creativity because the additional unusual flavours, such as popcorn with the taste of cracklings, Kulen and truffles, are in the process of preparation, while all the sweets lovers will be delighted by the fact that a chocolate-flavoured popcorn with almonds is also planned for production. In addition, the grain used is of exceptional quality and exclusively locally grown, and the popcorn is baked in hot air and seasoned with hand-prepared spices in the factory. This is precisely the secret of their fresh texture and easy digestibility. They do not use any additives in the production and popcorn is prepared with only ten ingredients. All corn is supplied from the vicinity of Vukovar and butter, dehydrated cheese, chilli, dried tomatoes, chocolate, vegetables and olives are also supplied from local producers. Even the bags are made in Croatia. The founder Marijan Babić supports local producers and, thus, through cooperation, ensures the growth and development of their own company. The virtual store was launched in November, and in the first month of business, it had more than 500 orders. In December, they grew by 100% in the number of orders compared to November. They have further expanded their distribution through a wholesale channel through which they have reached small business partners. However, the best proof of the value of an authentic Croatian product is the number of more than 2,000 orders through virtual trade, and, in addition to the domestic market, orders come from Germany, Sweden, Austria, Poland and the neighbouring countries, such as Slovenia and Serbia.

4. Conclusions

A crisis is an adverse change in the market that occurs suddenly, without announcement. In recent years, there has been more and more discussion about crisis and crisis management because, with globalization, the very concept of crisis has changed. Its impact is now global, and transnational. The main task of crisis management is to determine the functions and processes aimed at identifying, extraditing, anticipating or, if possible, eliminating and preventing a new crisis. A crisis is a common occurrence on the market and should not exclusively be perceived as the harm that is done to business. Instead, the crisis should be seen as an opportunity, a call for the necessary changes for businesses to continue to grow. The first steps are always the most difficult: eliminating everything that does not contribute to the business, laying off inefficient workers and investing exclusively in staff and resources that contribute to the business. This is followed by a focus on the new situation,

⁷<https://www.buro247.hr/lifestyle/vijesti/u-zagrebu-pokrenuta-tvornica-kokica-zagreb-popup-corn.html>
(30.07.2021.)

additional investments, and improvements in technology. In this way, as it is described through the six case studies, the crisis can be seen as a positive stimulus to the necessary changes that create competitive advantages and ultimately result in profits. Crisis management will continue to gain more importance globally, and excellent crisis managers will be in great demand in the market. The world is entering a period in which crises will become the norm, and only those who have the best, bravest, most qualified crisis managers will be able to survive in the market and gain knowledge on how to improve their business. In support of this conclusion, the words of a successful Romanian American businessman, engineer and pioneer in chip development and the leading man of one of the largest technology companies in the world, Intel, have been quoted: "The crisis destroys bad companies, good companies survive the crisis, and the best ones, they learn from the crisis and use it as a chance for progress." - Andy Grove.

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CUSTOMS SUPPORT TO THE GLOBAL LOGISTICS SYSTEM DURING THE COVID-19 PANDEMIC

Ivana Plazibat

University of Split, Department for professional studies, Croatia,
iplazibat@oss.unist.hr

Nenad Grgurica

Customs Administration of the Republic of Croatia, Regional Customs Office Split
Nenad.Grgurica@carina.hr

Abstract. The emergence of the COVID-19 pandemic has led to an unexpected impact on economic and trade trends. Trade directions have been stopped in the national, European and world markets which has prevented further positive economy strengthening based on fiscal policies.

The customs administrations urgent response, as one of the international trade and global logistics fundamental factor, to this challenge was necessary. A series of measures aimed at fighting the coronavirus and to limit the consequences of the pandemic were taken. Needed requirements to address this issue were different organizational changes, import customs exemptions, export restrictions and a number of other recommendations were initiated.

The purpose of this paper is to identify if customs administration succeeds to provide effective solutions for ensuring import of medical equipment, flexibility in the import, export and transit of goods, also simplification of the customs service requirements to the economic sector as the crucial element for flow of goods and the efficiency of the supply chain in pandemic conditions. The paper will present the work of the customs service based on coordinated decisions of the Croatia Government, the European Commission and the World Customs Organization, aimed at minimizing the consequences of limited movement, quarantine and social distancing in international trade.

Key words: *customs system, global logistic, covid-19, international trade*

1. Introduction

An integral part of modern customs procedures in the digital environment is the use of information and communication technologies. The acceptance of technological possibilities has enabled the customs community efficiency with further cooperation of the participants in global trade (Plazibat and Grgurica, 2019).

The goal of e-customs, created using information technologies, is a fully electronic business and the creation of an efficient and modern environment for customs administrations through facilitated and accelerated exchange of goods in global trade. Direct results of e-customs functionality is the administration adapted to the economic sector with faster customs clearance of goods and data exchange, security and quality of goods in international trade. Special attention is paid to the operation of customs services through a functional integrated, secure and interoperable, available information system with access to all current data in real time available 24 hours a day. (Plazibat and Grgurica, 2020).

Information and communication technology increasing use has marked economic and fiscal global flows in international trade. The global environment has generated, in customs activities, changes in priorities, visions and doctrines in order to increase the efficiency of customs work (Demirović and Mataga, 2018).

Due to the COVID-19 pandemic, trade routes in national, European and world markets were stopped, which stopped and prevented further positive strengthening of the economy based on fiscal policies. (Maleš, 2020).

The customs system as one of the fundamental factors of international trade and global logistics offered an urgent response. Measures were taken which consisted of organizational changes, import duty exemptions, export restrictions and a number of other recommendations. It enables the flow of goods and the efficiency of the supply chain, as well as ensuring the import of medical equipment, flexibility in the import, export and transit of goods and simplified requirements of the customs service towards the economic sector. (Zlopaša, 2020).

During 2020, a pandemic of the COVID-19 virus surprised the whole world. Due to the geographical spread of the infection, the number of people infected and dead from the virus, and experts' assessments of GDP falling and the economic recession at the global level, the pandemic has become not only a medical and health issue, but also a national and international security issue. (Bilandžić, 2020). The first consequences of the coronavirus epidemic were manifested in a reduction in maritime transport activity. The first analysis indicated that the traffic was at a lower level than during the financial crisis of 2008. Given the highest share of maritime traffic, the entire international trade was automatically affected. (Prodan, 2020).

The global threat required a global response, the World Customs Organization took measures in its field of work. Customs administrations have become crucial for facilitating the cross-border movement of goods during the corona period, ie reducing the negative impact of COVID-19 in socio-economic developments. (WCO, 2020). In addition to reorganizing the work and implementation of customs procedures in special conditions, it is necessary to assume with analytical methods and data processing implementation the consequences that will occur in the future in global trade due to the pandemic, which will generate further activities and responses of the customs service.

2. Customs system environment in pandemic conditions

The pandemic consequences were immediately felt in the economic work sector. The production decline directly affected international trade. In the first half of 2020, Croatia realized 6.9 billion euros of exports, which is a decrease compared to 2019 of 7%, while imports decreased by 12.3% and amounted to 11.1 billion euros (Galinec, 2020). After global lockdown at the beginning of the pandemic, statistical data were a little more favourable, but throughout the year Croatian exports dropped by 2.3% (EUR 14.9 billion) compared to 2019, and imports by 8.6% (22.8 billion euro) (Galinec, 2021).

Due to the COVID-19 pandemic, the logistics sector has been globally a generator of change to secure supply chains. Because of the restrictions on the movement of consumers, companies have focused on the digitalization of processes and remote work, based on which the preconditions for the participation of logistical factors in e-commerce have been created. The pandemic global supply chain disruption pointed

to the importance of logistics for the economic sectors functioning. (Marketfinder, 2021).

The specificity of the crisis due to COVID-19 is that it limits and disrupts supply chains globally (Hrvatska, 2020). The medical, political and economic response at the start of the pandemic was to close the borders. An additional problem was created due to supply chains interruption in international trade. There was a possibility of shortage, in addition to basic life products, and goods intended for the operation of the economic sector, but also basic equipment to combat the pandemic. (Zlopaša, 2021).

With numerous disruptions due to the pandemic, not all areas of work have been stopped. First of all, this refers to new work forms and business models. In the conditions of various restrictions, working from home completely changed the business paradigm and accelerated, even before the pandemic started distance work process. (Cipek and Uljanić, 2021). Limitless development possibilities offer the purchase of goods and services over the internet. E-commerce development based on globalization guidelines and technological innovations, has been accelerated by the emergence of the COVID-19 pandemic (Buljan, 2021).

3. The decision of the croatian government

Considering the consequences of the COVID-19 virus spread, and in order to maintain and continue the customs procedures work, the Director of the Croatian Customs Administration made a decision to organize the customs service functioning in extraordinary circumstances in order to provide the support to the economic sector. That decision enabled customs procedures simplified implementation at border crossings. Imported goods were sent directly from the border to places of unloading without usual customs clearance at internal customs offices, continuously 24 hours a day so that supply chain logistics operations would not be interrupted (Carinska, 2020c). Due to measures taken to stop the Coronavirus spread, passenger transport on international routes to third countries has been suspended (Ministarstvo, 2020a). On March 19, 2020, the Croatian Civil Protection Headquarters issued a decision banning the entry of ships in international navigation into Croatian ports (Stožer, 2020). In accordance with the measures adopted due to the COVID virus pandemic in Croatia, and due to the drop in traffic, the airports working hours for international traffic is limited with the possibility of opening in case of emergency needs or circumstances (Ministarstvo, 2020b).

Due to the Croatian population protection against COVID-19 disease, the Croatian Civil Protection Headquarter temporarily banned or restricted the crossing of persons at border crossings, and temporarily postponed the opening of seasonal border crossings for international maritime passenger traffic (Narodne, 2020b). Transit traffic of heavy goods vehicles from other EU Member States through the Croatian territory and third countries is possible only through certain border crossings (Carinska, 2020b). Due to the significant increase in the need for protective equipment to prevent the disease spread and to protect the medical staff health and infected patients, the European Union has taken urgent measures to avoid critical situations. In order to ensure a sufficient supply in the Union, the protective equipment export has become limited and possible only with an authorization issued by the Croatian Customs Administration (Carinska, 2020a).

Further strengthening of fiscal sustainability was the basis of the Government of the Republic of Croatia fiscal policy before the outbreak of the pandemic. In order to reduce the coronavirus pandemic negative socio-economic consequences, the Government of the Republic of Croatia has created fiscal support for the purpose of maintaining overall economic activities. (Republika, 2020).

Due to the economic crisis, the Government of the Republic of Croatia has established a fiscal policy of reducing liabilities or providing subsidies in order to help the Croatian economy. (Kusić, 2021). In accordance with the decisions of the Government of the Republic of Croatia, the Customs Administration implemented measures regulating the actions of customs officers and other participants in order to enable safe import and export from the European Union through customs offices at the Croatian border. (Zlopaša, 2021).

In the customs system area, economic operators were provided with quality support in the customs procedures implementation and unnecessary administrations elimination. Contribution to the business entities savings will be achieved by sharing and managing knowledge and information. Also, obtaining feedback on the level and quality of Customs Administration performance. Orienting business people to use simplified operations, with a continuous balance between customs controls and movement of goods acceleration, will facilitate legal trade and the overall burden on the economy. (Republika, 2020).

4. Decisions of the european commission

In addition to restricting travel across the European Union's external borders, in order to stop the virus spread, measures have been taken to control internal borders between Member States. That has seriously affected the functioning of the single market considering that the EU and the Schengen area is characterized by a high degree of integration of millions of people who daily cross the internal borders (European, 2020c).

On March 16, 2020, the European Commission adopted measures that all EU internal borders should remain open for trade in order to ensure supply chains. Member States that have introduced internal border controls have been urgently asked to designate "green lanes" at border crossings in land, sea and air transport to enable supply chains functioning in the EU (European, 2020d). The pandemic has caused restrictions on a number of products in exports and imports in a short period of time, disrupting supply chains. Bottlenecks have been created in the production of basic stocks and crisis situations have been created in logistics, distribution chains and management of warehousing activities. Due to the introduction of an entry ban through border customs offices, it was necessary to establish cooperation between countries in order to ensure economic continuity, guarantee the flow of goods and supply chain, and the market and transport functioning. (European, 2020b).

The European Commission has set restrictions on the export of medical equipment used to reduce the coronavirus effects, and for the same purpose, a regulation has been passed exempting customs duties on goods intended to combat the pandemic (Zlopaša, 2021).

In transport of goods and services collective and coordinated action was necessary to ensure economic continuity. There was customs fundamental function that with control

procedures do not slow down and limit economic activities continuity, but on the contrary, preserve the supply chains function. The availability of basic products, food supplies, medical and protective equipment and other goods was maintained by the unhindered transport of goods established by customs measures that did not cause disruptions to supply chains. The key decisions were in goods delivery area, with Member States having to maintain the free movement of all goods. Restrictions on the movement of goods in the EU single market should not be imposed, and in particular the supply chain of basic products such as medicines, medical equipment, essential and perishable foodstuffs and livestock should be guaranteed by Member States setting priority freight routes (eg. By 'green routes'). The European Union countries have implemented the proactive functioning of the entire supply chain in order to achieve a balance between the shortage of goods due to panic shopping and the dangerous overcrowding of shops in meeting social needs. Therefore, airports and seaports and other logistics hubs were strengthened organizationally as needed. (European, 2020a).

5. Decisions of the world customs organization

The World Customs Organization continuity is to develop and update rules and recommendations to facilitate customs services' adaptation to changing global trade scenarios. Since 2008, the Customs in the 21st Century document has defined a security strategy through global customs administrations networking and risk management. (International, 2020).

The June 2010 decision established a World Customs Organization (WCO) strategy defining the customs' role in providing assistance in disasters. Customs administrations disaster readiness and effective and efficient response to emergencies is enabled by the level of readiness and ability to manage emergencies. The recommended and operational measures have facilitated the entry, exit and transit of disaster relief staff and measures to expedite customs clearance of aid consignments. By using existing customs clearance systems to ensure fast, efficient and centralized processing of consignments, border management has been achieved in a simplified and coordinated way. (Customs, 2020).

Anticipating further developments in the cross-border movement of goods due to the pandemic in March 2020, the WCO Secretary-General called on all members' customs administrations directors to establish cooperation and share best practices to prevent the spread of the disease. At the same time, the secretariat drafted a document with measures to mitigate the effects of the global crisis. Within the four basic measures, in addition to facilitating cross-border traffic, protecting society and protecting staff, the key measure was to support the economy and maintain the supply chain. Sustainability of supply chain continuity is ensured by the availability of customs officers 24/7 and by setting priority lanes for freight transport and flexibility in document and goods control. (WCO, 2020).

Since January 30, 2020, when the World Health Organization (WHO) declared a pandemic of the new coronavirus (2019-nCoV), the world has faced the biggest challenge so far. The fight against the virus has increased imports and exports of goods such as medicines and medical equipment across borders. In its recommendations for international traffic, the WHO emphasized that restrictions on cross-border traffic can

disrupt necessary assistance and technical support delivery, and also disrupt business with negative social and economic effects. It is therefore crucial that customs services introduce procedures simplifications to reduce the overall COVID-19 outbreak impact on economies and societies. The World Customs Organization is also encouraged to establish a coordinated and proactive approach with all actors involved in international trade to ensure the continued global supply chain facilitation (WCO, 2020b). The World Customs Organization (WCO) has been closely following developments related to the coronavirus pandemic outbreak. Following the Emergency Committee meeting on 30 January 2020, the WCO established communication to ensure that WCO members have been informed of the situation in real time and included in national strategies in order to reduce the pandemic consequences. The WCO members-the customs administration, are the first and last line countries defense, and customs officers are among the first to be in contact with passengers, crew members in all modes of transportation, and are an indispensable integrative factor of pandemic response mechanisms (WCO, 2020c). The World Customs Organization has been taking a number of measures with international transport operators. Namely, the COVID-19 impact on the aviation industry was that a large part of the international mail has been transferring from air to sea and land transport. Thus, with the Universal Postal Union (UPU), on April 15, 2020, it established the customs administrations and postal operator's coordination in order to further facilitate the global postal supply chain and mitigate the overall pandemic impact on society (WCO, 2020d). Unprecedented global situation due COVID-19 spread required an urgent slowdown disease spread and a mitigation of its impact. Travel have been restricting, and measures have been taking at the borders, which affected traffic hubs due to the closure and prohibition of entry to ships. It was therefore crucial that customs and port authorities facilitate the cross-border goods movement, in order to reduce the overall COVID-19 pandemic impact on both the economy and societies (WCO, 2020e).

6. Conclusion

One of the key actors in combating the negative effects of the pandemic was the customs services. During the implementation of activities in the legal and fiscal areas, special attention is paid to organization of the customs service work and its recognizability and visibility in the global environment.

Despite the environment of the customs system in a pandemic conditions: limited social contacts, temporarily stopped traffic flows and other various restrictions, as result to technological and digital advances, the customs service has been able to support international trade and prevent threats to the logistics system and supply chain.

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PROACTIVE SALES TECHNIQUES – A CASE STUDY

Sandra Mrvica Mađarac

College of Applied Sciences “Lavoslav Ružička” in Vukovar, Vukovar, Republic of Croatia
smrvica@vevu.hr

Sladana Brajević

University Department of Professional Studies, Split, Republic of Croatia
sladjana.brajevic@oss.unist.hr

Zvonimir Filipović

PIK VRBOVEC plus d.o.o., Osijek, Republic of Croatia
zvonimir88@gmail.com

Abstract. The modern sales market is flooded with products, therefore trading companies use different sales strategies and techniques to increase their sales and to attract customers. When scheming a sales strategy, various factors are taken into account, such as: controlled variables (product offer, company location, relationships with the suppliers) and uncontrolled variables (consumers, technology, seasonal impact, legal regulations). When working with the customers, sales team are facing obstacles on a daily basis. So, in order to smoothly communicate with the customers, proactive sales techniques are being used.

With the use of proactive sales techniques, the customer is approached on an affirmative way, because the trade companies want to educate their customers where on this way are obtained the benefits of this sales method. Within the proactive trading companies, they are performing product presentations, self-analysis of their approach to the customer, the analysis of the market demand segments is performed, and also analysis of the sales market, and on that basis, sales preparation and proactive approach have been counted in. Proactivity in sales represents a combination of different elements: those of self-initiative, determination, competitiveness, inventiveness, persistence, adaptability, focus on success and loyalty to the customer. One of the proactive techniques is to improve sales by means of using different tools. In sales situations when customers are dissatisfied or demanding, techniques for assertive communication in sales are implemented. Effective sales process management can be a turning point in a company's sales business.

In this paper are analysed sales strategies and tactics, types of proactivity, sales improvement, proactivity cycle and application of proactive sales methods on the example on one trading company. The results of this work indicate the benefit of applying proactivity in sales on the example of the observed company.

Key words: sales strategies and tactics, sales improvement, proactive sales methods, case study

1. Introduction

In a trading company, the sales function is the most important function since all other functions exist precisely for the matter of sales, and to ensure that sales are carried out smoothly. Sales business constitute a bridge between production and the market, i.e., the final customers. Every trading company has its own sales strategies. Today, the competition on the market between products and companies is severe, and retailers are fighting for their customers. That is why sales techniques and sales methods are imposed, by which we want to keep existing and attract the new

customers. Proactive sales techniques are one way to attract customers. Proactive techniques are guided by the company's management that manages its employees and requires them to think proactively.

In the paper are analyzed proactive sales and the benefits it brings on the example of a trading company. Company X is a food production and sales company. The research was conducted by means of the method of oral interviews with the company's management.

2. Sales techniques and strategies

Sales is the performance of appropriate tasks in order to realize products on the market, i.e., to bring them to the consumer to serve their purpose, and to turn the product into money to enable business continuity (Bratko, Henich, Obraz, 1996). The basic goals of sales are: achievement of the optimal turnover by harmonizing sales factors with customers and consumers, to ensure stability and development of business entity by retaining existing and conquering new markets, to eliminate or reduce market risks, which are: quality risk, turnover risk, price risk, quantity risk, customer risk, transport risk and business reputation risk (Ružić et al., 2002). The classic sales process includes phases such as: planning the delivery of goods to an individual customer, defining the minimum difference in price, creating an offer, negotiating, contracting, delivery, invoicing and payment (Perkov, Pavlović, 2018). The main corporate strategy of a trading company can be structured from several functional strategies (such as financial, marketing, human resources strategies, and others). The task of strategic management is to establish coordination between several functional strategies (Dunković, 2015). The strategy must identify what are the key activities in the company and to provide answers to the questions: "what our business is, what it will be, what it should be?" (Drucker, 1999). The concept of a balanced performance matrix dictates that a company's strategy should primarily emphasize on financial goals that will lead to a company growth and increased productivity, followed by the goals that are related to customers, internal processes, and employees (Kaplan, Norton, 2000).

Through the sales strategy it is necessary to plan (Levy, Weitz, 2012):

- The target market in which the seller will invest his efforts.
- A format through which operations will meet the needs of the target market.
- Which goods and services will be offered to the target market when using the intended format?
- On which the competitive advantage over rivals will be based?

Sales force management to explore the three main issues: what decisions a company makes when designing sales forces, on which way a company makes recruitment, selects, trains, monitors and evaluates sales forces, and how salespeople can improve their sales; how they proceed with negotiations, and keep the marketing skills (Sekso, 2010). Sales management consists of three main elements: planning, organization and control. Sales planning must include setting of the sales function goals, defining of the market forecasts, and setting sales budgets. The goals of the sales function are derived from the annual plan of marketing activities that reflect the possibilities and potential of sales in selected market segments. Sales are planned at the level of the entire company, for different sales sectors and for all of the geographical areas that are covered by the company. The budget of the sales function represents the total amount

of funds intended for the conversion of sales effort into actual sales determined for a particular sales period (Tomašević Lišanin, 2010).

Strategic marketing plan should include: plan summary (brief overview of actions and responsibilities for their implementation), analysis of internal and external factors (analysis of consumers, competition, markets, environment, investment and strategies), strategy development (costs, differentiation, competitive advantage, level investment, growth directions, optimal strategies and alternative strategies), strategy presentation (presentation of selected strategies and comparison of their measurable characteristics), annual plan (presentation of the selected strategy, presentation of a strategy for the program implementation, presentation of detailed financial plan for the next year) (Marić, 2006). The competitive advantages of a company ensure profitability in the long run. Their establishment is the key to a successful execution. Because the business strategies are based on competitive advantages, hence their priority. During the growth phase of a company, business strategies precede corporate strategy. The allocation of resources would be unnecessary if the corporation were not able to determine the competitive advantages in each of its activities or in each business unit (Buble et al., 2005).

Priorities in retail management in accordance to the IGD Retail Analysis research are (IGD Retail Analysis, 2014):

- Prices and promotional activities.
- Strengthening of the long-term planning of the supplier relationship.
- Improving and enhancing of the supply chain.
- Launching of new, branded products.
- Use of the multichannel distribution.
- Understanding of the customer behavior.
- Sustainability and green growth.

Functions, forms and methods of sales change on a daily basis and they adapt to the market requirements. Therefore, there is no perfect product or service that does not need to be sold in order to reach its full potential (Tomašević, 2013).

3. Proactivity in sales business

Proactivity implies proactive behavior that comprises a set of actions that acts as a preparation for a future situation, and not just as a reaction or response to a situation that has previously occurred. This means taking over the control and doing things, not just adapting to the situation that has happened or expecting what will happen. Proactive people, i.e., proactive employees, do not have to be encouraged to react by their superiors, they do not even require detailed instructions on what to do. If we compare proactivity with adaptability, it can be concluded that adaptability would turn out to be a successful adaptation towards certain changes in the organization initiated by others, while proactivity would mean just initiating change from ourselves. Proactive communication understands an existence of a lifecycle strategy of customer relationships in order to improve customer loyalty. Proactive communication includes active communication that is manifested through social networks and multi-channel contact with society. Through proactive communication with customers, they strive to anticipate and improve all interactions with each other, in order to personalize them and set additional increase in efficiency for each client individually. In today's large

corporations, employees invest almost all their energy to adapt to the current situation in the corporation and the environment they mostly often find existing: instead of such an approach, employees should propose changes, to recognize potential threats and opportunities, and act in advance to avoid some situations that will not be looking good for the organization as a whole. Proactive behavior also carries with it certain risks that manifest themselves through increased employee stress. Although the proactivity carries certain risks, it is invaluable in terms of maintaining the organization's survival in a competitive environment, and further organization's prosperity in the future. Proactivity and reactivity appear as two opposite poles found in human behavior. From the individual point of view, proactive behavior can be focused on changing oneself in terms of acquiring some new skills, or it can be focused on changing the environment, in terms of giving a certain suggestion on how to improve a particular service. Different tasks within an organization can be considered active; such as seeking feedback related to specific tasks, making suggestions for improving of the specific processes, and many other similar activities. Common to all these activities is that they can be characterized as independent, as well as change-oriented and future-oriented. Proactive employee behavior encompasses a number of different patterns of behavior that include self-initiated, anticipatory action aimed at changing of oneself or to get the situation change. By means of definition, examples of proactivity include (Bindl, Parker, 2010): taking responsibility for set of the improving methods and ways of working, solving problems in a proactive manner, using one's own initiative, reaching certain agreements with the employer to meet certain needs of workers (flexible working hours, shorter working hours), and similar conditions with which an employee is rewarded for better work efficiency and to proactively seek for the feedback information's. Proactive behavior has been proven to have a positive effect on employee efficiency in the workplace, and thus on better productivity of the organization itself, and also to has a positive effect on managing one's own career. Research that was conducted by Grant and Parker identified the so-called career proactive behavior. This implies the proactivity of the individual when the individual is retaining a particular job or he is about to find a new job, or when he is positioned in negotiating activities that lead to better conditions when accepting a job. If you find an individual with whom it is difficult to negotiate with when hiring for a job, it is possible that this situation represents an indicator of a potentially proactive employee (Rousseau, 2006). Psychology of work is mainly concerned with understanding how our personality traits affect different behaviors at work and consequently to incite proactive behaviors. The work environment itself can influence on the encouragement of proactive behavior. That is why it is extremely important to know of what kind of work environment you are building, and also what kind of experiences you're providing to employees. To shift additional focus to the topic of proactivity in enterprises, the researchers have identified a number of elements that are related to the work environment that management can apply to influence on proactivity, namely: job design, leadership style and organizational climate. We tend mostly to intuitively think that proactivity is only initiated and that our behavior is conditioned by our own personality traits, however numerous studies have indicated that the work environment can also positively influence on proactive behavior. During our lifetime, our personality changes, so that over time and shaped by certain experiences, we become more confident and emotionally stable, and therefore more conscientious in doing our job.

Conscientiousness is positively associated with proactive behavior; conscientiousness is a relevant character trait that occurs as a reflection of behaviors that are related to reliability, compliance, and perseverance. Unlike other character traits, conscientiousness is highly associated with proactive behavior in the areas such as, proactive job search, proactive task execution, and proactive job information retrieval, as well as career planning behaviors. Conscientiousness assumes proactive behaviors in terms of coherence between workers and the environment, such as directly seeking feedback, what is also true for the indirectly seeking feedback that is influenced by our confidence in our own abilities that are linked towards the breadth of work roles and a sense of responsibility for a change (Parker, Collins). Conscientiousness has not proved to be an essential dimension in the case of proactive behaviors aimed at taking control on leadership and on individual innovations. The assumption is that conscientious individuals are more likely to behave cautiously and to respect the rules of the organization.

For the character trait of openness towards an experience, exists numerous studies that conclude that it is not reliable to predict proactive behavior for people with more pronounced openness to experience. While this trait involves exploring of the unknown what stands in correlation with the proactive behavior, it also involves respecting the opinions of others, which can lead to a reduced desire to take initiative and also not to encourage change. Employees who possess a strong intellectual curiosity are more likely to be engaged in an analysis of the work environment, especially when gathering useful information outside and within the organization, than it's the case with the less intellectually curious employees (Howell, Shea, 2001). Those employees who have more consideration for the future consequences, to the extent that someone considers the effects of the future consequences over the current ones, show greater proactivity; while employees who overly feel resistance to change at work show less proactivity.

Extroversion has an impact on the behavior of the individual that seeks information from others, whether open or covert, without asking why data is needed, when seeking feedback, and building relationships with the new co-workers with the self-initiative and expression. Extroversion often leads to developmental activities throughout the greater motivation to learn. Comfort as a character trait does not have a direct correlation with proactive behavior at work. Neuroticism is generally not associated with proactive behavior or even has a negative effect on a proactive behavior.

This model of the "The big 5" emphasizes the key character traits in terms of the personality dimension. However, this model does not cover all character traits, and a large number of studies have shown how other personality traits can shape and influence on proactive behaviors. Individuals who are not comfortable with intimacy, the role in which one should rely on them, and emotional connection with others, are less likely to be engaged in proactive behavior (Wu, Wen-Dong, 2012).

It is not enough just to hire workers who have shown a pronounced inclination for proactive behavior. Due to the influence of the work environment and relationships in the organization, if favorable conditions for proactive behavior such as job autonomy, complexity and challenging work are not provided, even individuals with a greater propensity for proactive behavior will reduce their proactive behavior over time. Work autonomy implies the freedom of workers and also the degree of freedom when deciding and planning on how to do their work. Participation in decision-making is

strongly correlated with the job autonomy. This means that if workers have greater autonomy of work, their participation in decision-making will be seen as purposeful, relevant and focused on organizational goals. The next noticeable connection lays between the criteria of work and affiliation to the organization. If workers are able to choose and adjust the way for the expected results will be achieved, it will affect and increase their affiliation to the organization. It is interesting to observe the influence of working hours and rest from work, for example, for the morning feeling of rest from work it was found that it has influenced on a higher level of self-initiative of workers during the same day (Binneweis, Sonnentag, Mojza, 2009).

The most important characteristics of proactive people are: developed self-awareness, assertiveness; they practice creativity and have internal focus of control, they are focused, responsible, take care of their circle of influence, they practice self-control, they are dynamic and have a vision of the future. Proactive people know themselves very well, they are aware of their strengths and weaknesses, and strive to actively improve their weaknesses. Proactive people are assertive in communication and that helps them to maintain good relationships, and to get what they need. Through the assertive communication, they manage to explain a situation to their superiors, for which they could see it is not the best solution for a particular situation. Proactive people are creative and they find solutions for all kinds of problems that get on their way. Their locus of control is internally positioned, which means they take responsibility for what happens to them instead of blaming the environment, and this allows them to change the situation, - either by modifying their behavior or choosing the way for what has happened that affects them. Being proactive also means being focused on the job, and not on side issues around it like couloir stories or objections. Proactive people take responsibility for their tasks, anticipate possible failures and learn from them. Their circle of influence tends to grow, so their resources expand. The skill of a proactive person is also their emotional self-control. Proactive people do not allow their emotions to dominate once in stressful situations, so they are active, resourceful and energetic, and they often suggest changes that can improve business. They have a vision of the future; they applied the long-term thinking and anticipate difficulties that may arise in the future. Proactive people are generally happier because they do not leave their happiness to circumstances: they are aware that they always have a choice (Covey, 2004).

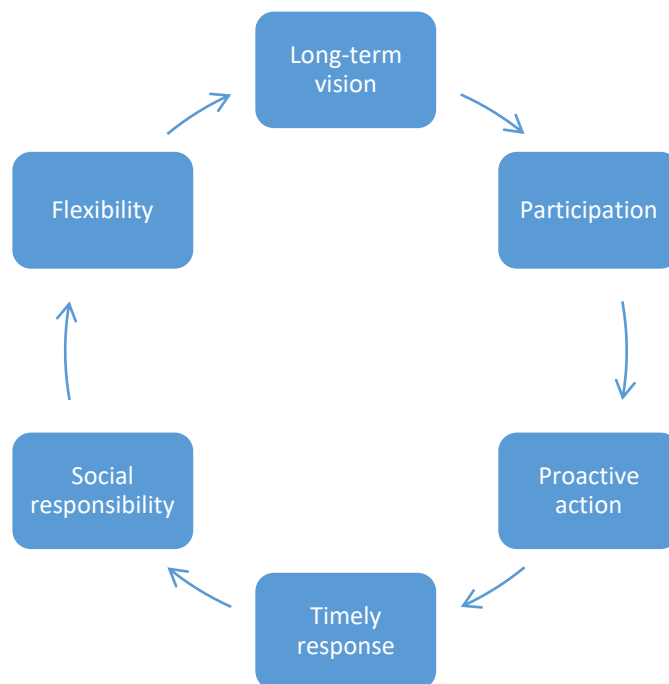


Figure 1 Proactivity cycle (author's work)

The proactivity cycle implies the possibility of related action of certain personal characteristics that continuously complement each other, and form one cycle that creates the basis of proactive action. Each of the individual characteristics is an equally valuable cogwheel in the proactivity cycle. In order for a company to achieve a leading market position and maintain such position in the long run, it is extremely important how its employees think. Without proactive employees, the long-term success for the company does not exist. Proactive behavior is most pronounced in the sales sector of a company that is in a constant communication with customers, and strives to develop and maintain better relationships. A company cannot just hire proactive people; it must create them from its existing pool of employees.

3.1. Sales improvement as a proactive technique in the sales business

"American Marketing Association (AMA) defines sales improvement as those marketing activities that do not fall within the range of personal sale, propaganda and publicity, and that stimulate the customers to purchase, as well as the efficiency of the mediator in presentations, demonstrations and other non-typical sales activities. Sales improvement is a form that is complementary to other forms and stimulates all forms of saving money when purchasing" (Kesić, 1997: 242). Sales improvement often attracts customers who often change brands because, those who do not use that product or use another brand, look for cheaper or more cost-effective products. Thus, sales improvement encourages customers to try new products, rather than constantly using one and the same, and also informs the consumer of prices, as they like to buy products at special prices (Kotler, 2006: 785).

A number of instruments can be used in order to achieve the objectives of sales improvement. The plan for sales promotion should take into account the type of market, the objectives of sales improvement, competitiveness and cost-effectiveness of each

instrument separately. The main promotional tools intended for consumers are (Meler, 2005: 293):

- samples - small quantities of products offered to consumers for testing
- coupons - documents that guarantee discounts for consumers when purchasing a product
- offers of refund (rebates) - a partial refund that the consumer receives after sending the manufacturer a "proof of purchase"
- packing at a better price - reduced price which is highlighted by the producer on the label or packaging
- premiums (gifts) - products that are offered either for free or at a lower price as an incentive to purchase goods
- special promotional material - useful items that carry a company logo and are given to consumers as gifts
- reward for loyalty - money or other rewards given for regular use of the products or services of a certain company
- promotion at the point of purchase (POP - Point of purchase) – point-of-sale display and product presentations in stores
- contests, raffles, lotteries and games - a type of promotion that offers consumers the possibility to, by playing games of chance or putting an effort of some other kind, win something, such as money, a trip or a product.

4. The research methodology

Data present in the survey were collected by the use of a method of interview in February 2022 with the engaged representatives of the company's management. Prior to the research, the representatives of the respondents were acquainted with the subject of the research and its goals. An interview has been proceeded using the oral survey, a special form of conversation that differs from "regular" conversation formally, substantively and psychologically: the interview was conducted with a specific purpose and goals according to a pre-prepared plan; therefore, it is known exactly who the examiner is and who is the respondent (Pavić, Šundalić, 2021). The main goal of the research was aimed at identifying proactive sales techniques of the company. By the use of the case method, we aim to connect the relationship amongst theory and practice, i.e., between deduction and induction. In the case method, in addition to the theoretical part, cases from the practice are also presented (Baban et al., 2002). The case study method deals with the study of some of a phenomenon as a set of circumstances in which there seems to be no cause-and-effect sequence. In order to gain useful experience, it is necessary to observe not one but several cases. On this way, tendencies towards the studied phenomenon can be reached (Ivanović, 2011). The aim of this research was to determine whether the observed company used the proactive techniques in its sales business.

In accordance with the set theoretical-methodological approach and the title of the issue, we have set the main hypothesis:

H₁ - The observed trading company proactively approaches its customers and proposes solutions to sales situations.

5. Proactive sales techniques - case study

Company X is a recognizable brand and market leader in Croatia in the production and sale of meat and meat products, and its products are exported to the foreign markets, with exports accounting for 10% of their total annual sales. Since it is a manufacturing company that cannot perform its basic function of production without the appropriate supply of raw materials, it is clear that the purchasing function is one of the most important functions of the company. Production results in the creation of added value, and in order for this added value to be competitive on the open market, it is necessary to ensure the highest quality raw material at the most competitive purchase price through the function of procurement.

For a company, in order to achieve a leading market position and maintain it in the long run, it is extremely important how its employees reasoned. Without proactive employees, there is no long-term success for the company. The proactive behavior of employees in company X is most pronounced in the sales sector of the company, which is in constant communication with customers and strives to develop better relationships between the company and the consumers. Company X cannot only hire proactive people, so it must create them from the existing employees. Sales staff is in charge of taking care of clients (buyers) and achieving certain sales plans and goals of the company. Sales staff continuously undergo through sales education and training in which, with the help of realistic scenarios and examples from their own business practice, and with the help of internal or external trainers, they practice a certain situation in the spirit of proactivity. A proactive employee represents an immeasurable competitive advantage for any company over a reactive employee. An employee who notices and appeals to the behavior of the competition and proposes solutions from his domain, in order to neutralize the moves of the competition, is a real example of a proactive employee. Sales staff must be very well acquainted with the novelties in the company's offer, with the new products and services, and this is achieved by means of a quality synergy of both of the departments: marketing and sale. In the company X, department of marketing through constant product presentations, for both new and existing products informs and educates employees, so that they can further present to their customers the benefits of their company's products. Employees must believe in the long-term vision of the company and in the products, they offer to their customers. This is achieved by means of a quality company management that leads the company in a transparent and visionary way, which indirectly affects the state of the proactive atmosphere in the company. On the occasion of the particular sales situation, together with the help of proactive techniques, sales staff educates their customers, in order to present certain benefits of their own products in relation to the competition. The competitive sales staff is not just adding a new product to their line but they also act as a seller, not only when selling a (competitive) product but they are also trying to present what buying a particular product represents to the customer in a positive way.

The proactive behavior of employees in company X is most evident in the proposed solution to sales situations, the proposal of new sales methods and new instruments to improve sales. In company X, the customer is approached in a proactive way, respecting his needs and differences. Depending on the sales format of the customer, it is approached differently with different amounts of sales resources, for example, it takes longer to access neighborhood stores and differently to hypermarkets. Company

X proactively approaches the customer by advising him on the product range depending on his market and has a regional approach. The customer who is a discounter is offered products that are more affordable. In the case of complaints, the customer is met to the maximum and the complaint is accepted as a signal that is not ignored.

When using sales promotion techniques, customers are constantly educated both at the point of sale and through the media and social networks. Sales promotion is carried out through additional work of sales representatives and sales managers at the point of sale, through the additional display and positioning of the company's X products. Sales promotion is also carried out through the managers who manages the key customers who, by means of the presentations to the customers give a broader picture of the product benefits, if they put such products on the shelves of their outlets. Marketing through sales promotion techniques and methods works in a way that opens the mode on the market for the sales force in the field to do quality sales. Marketing through the media and social networks of sale conducts advertising campaigns in which they promote products that are currently in focus. Only when the customer becomes aware that he indirectly achieves numerous benefits when buying products X from the company, it can be said that proactive sales has done their job well.

If in the company X most often has been used sales promotion instruments to encourage trade, in order to convince retailers to sell certain products, display them better on their shelves, promote them and offer more of them to the consumers. A direct discount is agreed on a certain product group or brand during a certain period of time, in order to better position of the group product on the market that is in the current focus of the company. Additional bonuses are also used, most often when launching new products, in order to encourage the retailer to better i.e., more visibly position the new product. When placing the new products, free or gift products for retailers are often used so that the customers will be able to try the new products, and from their own experience, to decide what benefits they will bring to the market. The products are accompanied by free promotional material in which is described all of the advantages and all of the benefits that the product brings. Significantly, sales promotion instruments are also used to stimulate business, and they are intended for consumers and retailers. Each year, in a certain place by means of the previously planned and realized marketing budget is populated by the specialized fairs, prize games and additional bonuses for the sales staff. During the year, the Company X participates in several specialized fairs in the country and abroad, where it presents its own products, makes certain business contacts and arranges future business cooperation. Throughout the year, several prize games are also organized for both end consumers and retail sales staff, in order to further motivate them to buy products, or to motivate customers to buy certain products. Sales promotion instruments are used to a minimum to encourage end consumers. At the points of sale, gustation's are mostly often used where customers are given the opportunity to try certain products, and also to customers are given promotional materials such as pens, key rings, kitchen towels, gloves and similar products. We'll try to motivate customers with the small signs of appreciation for them to continue to buy the products of the researched company, and to create and maintain a certain loyalty to the manufacturer.

The Company X sales staff, regardless of the level at which it operates, must work proactively towards both clients and colleagues who are hierarchically connected. This

is the ideal that Company X has been striving for, and by which it has managed to become a market leader.

6. Conclusion

In order for sales to receive their results, it is necessary to use different sales techniques and sales improvement instruments. With a well-designed proactive approach to sales business and greater use of sales promotion instruments, trading companies can further attract their customers and to contribute to their competitiveness. The company approaches its customers in a proactive way by proposing the best sales techniques, individual product range and consulting.

The success of the sales business also depends on the success of the company's marketing program. Sales promotion brings a number of benefits to the company, to the trade and the customers, and consists of a number of different actions that can be taken in the sales area to introduce customers to the new products, or to remind them of existing ones.

Company X, which is the market leader in the production and sale of food products, due to its well-designed sales strategy, uses various sales techniques to maintain their leading position on the market. Through various educations and guidelines, it encourages its employees who work in sales department to be proactive in business. On this way, employees have a vision of a good company's business, and they create a proactive atmosphere in the company, which ultimately results in good sales results. Company X uses sales promotion tools to draw customers' attention to their products and to encourage customers to buy their products. When considered the results of the analysis of sales techniques in the observed company, the hypotheses H_1 is confirmed - *The observed trading company proactively approaches its customers and proposes solutions to sales situations.*

Statement by Sam Walton (the founder of Wal - Mart): "There is only one boss: the customer. He can fire everyone in the company - from the president down - and easily - if he decides to spend his money elsewhere", has proved to be true in today's times of severe competition.

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GENERATION Z ONLINE BEHAVIOUR WHEN PURCHASING FASHION PRODUCTS

Katja Rakušić Cvrtak

*University of Split, University Department of Professional Studies, Split, Croatia
krakusic@oss.unist.hr*

Danijela Perkušić Malkoč

*University of Split, University Department of Professional Studies, Split, Croatia
dperkusi@oss.unist.hr*

Ivana Plazibat

*University of Split, University Department of Professional Studies, Split, Croatia
iplazibat@oss.unist.hr*

Abstract. Generation Z introduces new behaviour patterns that bring new challenges for retailers. It is the youngest group of consumers, whose attitudes and behaviour have a great influence on the retail strategy formation across all distribution channels. Information on the target group characteristics, as well as their attitudes and habits in online shopping for fashion products, is crucial for every retailer involved in fashion goods. The aim of this paper is to explore the attitudes and habits of Z generation customers in online shopping for fashion products across Croatian young customers. Fashion products include clothing, footwear, and fashion accessories for all occasions. Fashion products have always been the most attractive products to purchase and for that reason their presence is strong online as well. The qualitative research was conducted through group interviews. Three focus groups included respondents born in 1994 and later. Most of the respondents of the Z generation were students of professional studies programme. Results indicated the existence of polarity of opinions and attitudes among respondents towards the online fashion products purchase. Particularly interesting is the attitude of some respondents towards payment methods in online shopping that indicates further distrust in online payment. Since the purchasing power of gene Z is expected to increase over time, marketers need to understand their behaviour and adjust company marketing activities according to specific requirements of this generation.

Key words: *generation Z, fashion products, online purchasing*

1. Introduction

Online shopping has been increasingly accepted in recent years. The increased confidence in technology and online payment sectors are changing consumer behaviour, away from traditional methods (Khouloud, 2020). As an answer to this trend, most of the companies have launched their online portals to sell their products/services online. Between 2014 and 2016, online sales grew by 31% in the United States (US) (United States Census Bureau. Estimated Quarterly U.S. Retail Sales (Adjusted1): Total and E-Commerce in Rao, 2019), 33% in Canada (Statistics Canada. Annual Retail Trade Survey in Rao, 2019), 41% in Australia (Australian Bureau of Statistics. Experimental Estimates of Online Retail Turnover in Rao, 2019.), and 85% in China (National Bureau of Statistics of China. Monthly Retail Consumption Increases of China in Rao, 2019). The Covid-19 outbreak gave an even more intense rise and increase potential to online shopping (Pham, et al., 2020).

This trend suggests that online shopping has significant potential and benefits to societies and businesses worldwide. Many studies have been published to describe and analyse customer behaviour and the main characteristics that determine the online consumer. Sometimes they result in different directions depending on the time of the analysis and other variable factors. Lynch and Beck (2001) have noticed that Internet users across various countries indicate differences in beliefs, attitudes, perceptions, and Internet buying behaviour depending on user experience, and home country or region. Bilgihan (2016) has researched the differences between consumer generations in terms of various consumer behaviour aspects in the online environment. Similar to this, some authors inspect the attitudes to e-commerce in connection with new technologies and differences between customers according to each generation group (Ramírez-Correa et al., 2019). Generational groups differ according to values, preferences, and shopping behaviour (Parment, 2013). Generational cohorts are comprised of people who are born during a particular period, and whose life courses correspond to each other. This phenomenon has been researched far earlier. Mannheim (1928, 1952) presented this stating that, "The social phenomenon 'generation' represents nothing more than a particular kind of identity of location, embracing related 'age groups' embedded in a historical-social process". Dorie and Loranger (2020) also state that significant differences exist between generational groups according to shopping habits. They differ in terms of how the Internet influences their life, the way of purchasing goods and services, the type of products that are bought online, and the kind of behaviour they have (Jilkova and Kralova, 2020). Swinyard and Smith (2003) found that online shoppers are usually young, wealthy, good educated, have high computer literacy, spend more time on their computer, and spend a lot of time on the Internet. Different generations and demographic consumer groups are exposed to (a) different social and economic opportunities and barriers, (b) different types of technology activities, (c) different social perceptions and different community norms, and (d) different life experiences and events (Hume, 2010). Similar to this, Ingelhart (1977) made research on generational differences and gave researchers a tool to analyse changes in population over time. This author refers to divides of the population into generational cohorts according to their years of birth. Generational cohort marketing has become a useful tool in segmenting markets since cohort members share similar values and generational cohorts have different experiences, which influence their values, preferences, and shopping behaviour (Parment, 2013). An especially important field of research about the specificity of individual generations refers to the context of the online environment. Penetration of new technologies among young generations and the availability of the Internet have encouraged the use of online shopping. Customers use different kinds of devices to seek products and finalize the purchase (Kannan, 2017) Furthermore, as a consequence of this trend, the number of online stores has increased dramatically lately (Wang, 2017). Consumers mostly assert the following advantages of online shopping: convenience, selection, price, original services that may be available online but not elsewhere, personal attention, easy and abundant information access, save time and privacy (consumers may be able to buy items that they may be reluctant to buy in-store) (Ayuni, 2019, Ahuja et. al., 2003). Ayuni, R. (2019) states that Gen Z will significantly affect business strategies and induce companies to reorganize their business models. One of the alterations refers to a new paradigm shift by companies

from the traditional business model to an internet-based business model (e-business model/e-commerce). Online shops have escalated at a rapid pace and have changed people's buying habits, especially for Gen Z. Apart from previous generations, Gen Z is onward in using high-tech products and more used to involve multiple information sources (Priporas et.al., 2017). Targeting this generation seems to be a suitable strategy to enhance their lifetime loyalty. This research examines the attitudes and behaviour in online shopping for Generation Z considering fashion products. Research is specific because it looks at a specific product category - fashion products. Also, it focuses on generation Z consumers as a specific market segment that is intensively technologically savvy. The research took place in Croatia, on a sample of mainly Croatian representatives of generation Z.

The results of study should be valuable to practitioners and theorists interested in consumer behaviour, especially the online buying behaviour of generation Z considering fashion products.

2. Generation Z

Zemke et al. (2000) made a differentiation of six generations to chronological sequence. According to that systematization, Generation X (Born between 1960 and 1980) presents the first Generation. They had experienced the internet for their formal communication like using e-mail or web (Tyler, 2008). Generation X is considered as a well-educated generation which had adapted technology to improve their career advancement. Thereupon, Generation Y (Born between 1980 and 1995) had experienced an intensive change of technology (comfortably using cell phones and the Internet) (Lissitsa & Kol, 2016). Finally, Generation Z (Born between 1995 and 2010) belongs to the period of accelerated technology (Desai & Lele, 2017). Different authors also name them as iGen, Plurals, Pivotal, and the Homeland Generation Tweens, The Founders, Generation 9/11, iGeneration, and post-Millennials (since they are grown up with a digital device, internet, and technology (Merriman, 2015; Mohammed, 2018; Williams et.al., 2010). They apply to individuals born between 1995 to early 2010s (Mohr and Mohr, 2017). Moore (2012) describes Gen Z as more individualistic, more tech-savvy, always connected, brand-aware, and more communicative than Gen Y. This population is still largely adolescents, but are characterized increasingly realists, self-aware, self-reliant, and persistent. It is also appreciable to mention their propensity for the Internet. (C. Goldberg, People, and relationships, tips, 13/01/2016). Beal (2016) described them as living in a "world of continuous updates". They can be characterized as well-educated, technologically skilled, innovative, and creative (Bassiouni and+ Hackley, 2014; Fister-Gale, 2015). Much of their lives take place online. Even 40% of them identify themselves as digital device addicts and 92% have a digital footprint (Beal, 2016). Gen Zers are used to being instantly connected and gathering information and communication channels instantly at their fingertips. This is also noticeable in communication since they favour socializing online rather than face-to-face. It also applies to the relationship with their favourite brands (Bernstein, 2015). This can be challenging for company managers since their habits and behaviour are significantly different from earlier generations (Schlossberg, 2016)

As notably informed members of society, Generation Z members strive to take charge of their lives and futures— which forms them slightly loyal to retailers in comparison to previous generations (Merriman, 2015). Because of their growing numbers and

dominance in global markets, Generation Z (Gen Z) consumers have become an alluring opportunity for retailers worldwide (Tunsakul, 2018). Wood (2013) singled out four trends that can characterize Generation Z as consumers:

- 1) An interest in new technologies,
- 2) An insistence on ease of use,
- 3) A desire to feel safe, and
- 4) A desire to temporarily escape the realities they face.

Consequently, the retailers are confronted with higher customer expectations and anticipation of an intense customer experience (Schlossberg, 2016). Ultimately, all this leads to new challenges for retailers as they need to find new and innovative ways to attract customers and keep their loyalty. Therefore, a better understanding of the perspectives and expectations of Generation Z is crucial. In a view of to contribute business and marketing theory and practice, present research aims to add theoretical and practical benefits and implications regarding Gen Z consumers' online buying behaviour with an emphasis on fashion products.

3. Data collection and analysis

For the purpose of this study, a qualitative research design was applied due to the exploratory nature of research (Creswell, 2009; Pantano & Priporas, 2016). This research approach gives a richer and deeper knowledge for exploring aspects and offers researchers to get a better insight into the understanding of the problem (e.g. Healy and Perry, 2000; Maxwell, 1996). To realize the purpose of research study, the authors conducted a series of group interviews with examinees that appertains to generation Z. Focus group or focus group interview is a qualitative technique for data collection. It is “a group comprised of individuals with certain characteristics who focus discussions on a given issue or topic” (Anderson, 1990, p.241) According to Denscombe (2007, p.115), “focus group consists of a small group of people, usually between six and nine in number, who are brought together by a trained moderator (the researcher) to explore attitudes and perceptions, feelings and ideas about a topic”. Concerning other methods of data collection e.g. questionnaire, observation, etc., an interview can provide a rich source for exploring people’s inner feelings and attitudes (Dilshad and Latif, 2013). Similar to this, Wisker (2001) claims that interview is a very convenient way for obtaining information based on emotions, feelings, experiences, ii. sensitive issues, and iii. insider experience, privileged insights, and experiences. For a sampling purpose, a non-probability purposive sample was chosen. Participants were selected according to their age to belong to the generation Z group.

The interviews took place in January and February of 2021. 25 students participated in the study. Overall, 3 focus groups were conducted. For a qualitative research study in general, recommended sample sizes should consist of fifteen to twenty examinees (Onwuegbuzie and Leech, 2007), while De Ruyter and Scholl (1998) point out that the most common samples range from 15 to 40 respondents. The qualitative interviews lasted for approximately about 1 hour.

The interviews began with introductory questions asking participants what they imply under the category of fashion products, do they buy online, which fashion products do they mostly buy online. The questions continued with more detailed motives and reasons for their buying behaviour.

The interviewees were familiar with the sequence of the interview, and with the ethical principles that will be maintained during and after the interview. Interviewers followed an ethical procedure that incorporates ‘no harm’, ‘informed consent’, ‘anonymity’, and ‘honesty’ (Allmark et al., 2009; Bell and Bryman, 2015). The interviewer explained the importance of being spontaneous and honest during the answering and that there was not a wrong or right answer. All participants were asked for consent to record the interview, and they were informed that the interview will be used only for academic purpose and that their anonymity is guaranteed. The data were analysed using thematic analysis. The information collected is grouped into categories and then analysed (Kapoulas and Mitic, 2012). Answers of all the respondents were analysed at the same time for each question to reveal similarities and differences in thoughts and behaviours.

4. Findings

When asked what they mean by fashion products, respondents mainly answered the following: clothes, shoes, jewellery, fashion accessories (bags, hats, scarves, wallets ...). Although they have experience in buying online, the Covid pandemic motivated them more intensively to buy online. Many of them said that their parents were also motivated for buying online and asked them for help.

Most respondents claim that the average spending limit by one purchase is average about 400-500 kn (50-70 Eur). They agree that the acceptable amount of shipping costs should be about 30 kunas (4 Euro). Some of them usually share their orders with friends or family to pay less shipping costs.

When it comes to gender, there are diametric different thoughts between men. A part of the male respondents claim that they rarely buy online and prefer to try on the clothes. While the other group of respondents doesn't like to visit stationery stores and rather like to buy online because it is more convenient for them.

Respondents usually don't prefer to use the option of product return because they perceive it as too complicated and tiresome, so they try to be as cautious as possible during shopping. In the following part of the article will be shown what products respondents buy online and their habits and attitudes when shopping online.

The subject of sale:

Respondents that buy online, mostly buy T-shirts, sneakers, informatics equipment and mobile phones, jewellery, and accessories. They usually don't prefer buying clothes online because they want to see how it fits them.

“I usually buy sports products – sneakers, because I already know what shoe number of which brands, I wear, etc... However, I prefer to try cloth to see how it looks on me.”
 “Lately, I buy more often online, mostly T-shirts and sneakers. When it comes to sneakers, I take the risk and sometimes have to return the product.”

“I prefer buying shoes and sneakers online. It is easy to take measures and choose the shoe number that suits me the best. Each shoe number is expressed in centimetres, so anyone can find its perfect number. On the other side, I don't feel convenient to buy clothes online because not all clothes suit my figure, so I usually prefer to try them before buying. I want to be sure seeing how it looks on me”.

“I dare not buy clothes online because I prefer to try them, so I don’t want to experiment and take risk of buying something that doesn’t suit me.”

“I would dare to order T-shirts online, but pants not”.

“I usually buy shoes, mostly famous brands”.

“I buy sneakers and jewellery very often”

“I often buy sneakers because I know my number and I usually buy the same brands, so I always know what to expect”.

I wouldn’t buy shoes online because I’m not sure how would it look on me, but jewellery is something that I’m not afraid to buy online”.

“I usually buy jewellery online and clothes that I am sure to fit me”.

“I usually buy cosmetics through trusted stores and bags”.

Respondents that don’t buy clothes online are mostly concerned with ordering the wrong number and the possibility that clothes don’t fit them. Maybe would future possibilities of augmented reality or the opportunity of ordering products according to body measures help to encourage these customers to buy online more?

Payment method:

Many respondents seem to feel uneasy about security issues during their interactions. Some respondents pay by all methods, and they don’t care, but the majority indicated that their preferred payment method is by paying cash on delivery. They feel more secure that way because they do not take any risk in case if there would be any delivery problems or if the merchant does not deliver goods at all. Some respondents noted that they have a card that they use exclusively to pay online. Few interviewers claim that they use all kinds of payment methods and don’t care about it. Whatever merchant requires, they will use it. Some of the answers are listed below:

“I only choose pages that offer cash on delivery, I have disbelief about the cards”.

“I prefer Internet banking, but nothing is a problem for me”.

“I don’t like to leave card numbers on websites”.

“I’m afraid of what will happen to my data, whether the product will come, so cash on delivery is a perfect solution for me”.

It is interesting to note that most of the respondents answered similarly, only a few of them use cards and other payment methods. They are mostly afraid about the security of their data and possible delivery problems if they pay in advance. Some respondents prefer Internet banking, so maybe this option could be perceived as less risky than leaving credit card data. Using services like Paypal, Revolut or similar could maybe be helpful.

Promotion and website organization:

Respondents claimed that they prefer pages with good ratings and customer reviews are an additional feature they value when choosing a site to buy. Furthermore, many respondents said that realistic images would motivate them to make purchasing decisions.

“It annoys me if there are no reviews on the web”.

“I usually ask my friends for recommendations and seek pages that have good ratings and reviews. “

“I don’t like pages that don't work well if they are too slow, if they don’t have adequate filters or when there is no possibility of getting back to the previous page that has been looked but only getting back at the first page”.

“I like when I can easily find what I need, I avoid the opaque websites”.

I don’t like to see unreal models in photos, it demotivates me. If the model has normal proportions and if it is a “real photo”, that will encourage me to buy”.

“Realistic models are one of the most important factors when making a purchase decision. I like to see an "ordinary girl" promoting clothes, that the photos are not retouched, etc. I usually buy on domestic online stores”.

“I prefer real images and will be more eager to buy something if I see photos that real customers post matches the image in the ad, I almost buy immediately”.

“It annoys me when a product looks different from the one in the picture”.

“Reviews are one of the first things I look at”.

“I like when there is an option that I can see those products that I have previously searched for on the site interface”.

“I usually buy online once a month, I often look for discounts and would rather buy discounted products when something is not trendy than buy at full price”.

“I am usually attracted by online promotions, but I see very important that online shop is known and reliable”.

“Discounts usually irritate me, they promote the discounted price, but in fact, the price is the same as a month ago”.

Web promotions, layout, and organization of web stores are important factors of the overall impression of the shopping experience. Web shops should be simple, perspicuous, and have adequate filters for searching and selecting products. Another important factor that suppliers should think about is marketing ethics. The product presentation should be realistic, and many respondents consider customer reviews extremely desirable on the web shop.

Online shopping channel

The majority of respondents make their purchases via their mobile phones. They also use it for seeking products. They often find themselves searching for offers although they don’t have an intention to buy something. Sometimes they buy on official web stores of specific brands, or they use applications like AliExpress and Wish. Also, some respondents emphasize that they like to shop in domestic small online stores such as Facebook / Instagram boutiques. Some of the respondents avoid foreign web stores because they doubt the quality of the product.

„I like to order from domestic sites that I usually find on Facebook/Instagram. They usually have many ratings and comments, so I can be sure that they are reliable. Furthermore, many of them give the possibility to personalize the order in terms of number, colour, print”.

“When I’m boring, sometimes I scroll web stores on my mobile although I had no intention of buying anything”.

“I like to buy online and pick up in the store.”

“I avoid foreign web shops because I’m not sure should I get adequate product quality. If the quality were not adequate, I am afraid that the return of the product would be too complicated”

The fact that almost all respondents use their mobile phones for searching for offers and buying, it is essential to have web stores that are well adapted to mobile search.

Those respondents who don’t buy online still search for offers. Therefore, it is very important to have an attractive web shop with all the necessary product information, while other consumers reviews are an additional advantage that consumers appreciate.

Reasons for not buying online

Some respondents don’t buy online because of some previous negative experiences, or they yet not dare to buy online because they perceive a high level of purchase risk.

“I always look for products on the internet, but I don’t dare to buy, I rather like to try how it looks on me”.

“Given my body construction, it’s hard for me to choose clothes online because I don’t look like the models in the pictures. I prefer to see the cloth on me”.

Those respondents who don’t buy online stated that they are mostly in doubt about buying online they because are afraid that will order the wrong number. They also claim that they prefer to touch, feel, and try how those clothes look on them before they buy.

The previous negative experience with ordering the wrong number demotivated some respondents from continuing to buy online. They would eventually try a product in a store and buy it online if the price would be lower online. One respondent answered that an extra discounted price would be a good motivation for buying online.

Although some of the respondents don’t buy online, the importance of online channels should not be overlooked because customers still search for information online, keep track of promotions, etc. Some of them claim that they like to buy online, but pick up in the stationery store, so maybe one of the solutions of motivating customers to buy online should also be in the opportunity to reserve or pay product online and try/pick it up in a store and eventually make a refund if the product does not match.

5. Conclusion

The findings of this research enrich the existing literature and have certain implications for retailers and managers, especially for those who are interested for operating in the Croatian area. This exploratory study can be contributed to the existing literature on online shopping by researching generation Z consumers' stands and expectations regarding buying fashion products online. This research aimed to provide a better understanding of generation Z's online shopping behaviour regarding fashion products. The findings present generation Z consumers' perceptions, expectations, and online buying patterns.

As present study indicates, generation Z represents the young, technology-oriented group. They mostly use their smartphones very extensively, either for searching for information, supply research, or for purchase. It is important to notice that those who although don’t buy online, still browse web shops and search for information online. This certainly confirms the importance of being present on online channels and providing the necessary information to consumers.

The majority of interviewees emphasize the concerns of transaction security and usually choose the cash on delivery option as the most acceptable option. This discomfort about security issues has also been discussed in previous research about online interactions (Ayuni, R. F., 2019; Groß, 2016; Kimery and McCord, 2002; Tontini, 2016). Most consumers who do not shop online claim that the main reason is that they cannot see, feel, or touch the item and because of security concerns which are also in according to some previous studies (Taylor et.al., 2001).

According to the qualitative nature of this study and the size of the sample, it is not possible to generalize the findings to the entire Croatian generation Z. Future studies could involve larger samples. The same research can be done in some other countries to see if there are some differences in behaviour patterns between different cultures and countries. Furthermore, some quantitative methods and measures can be performed to get more detailed findings. Further research could include other generations to compare how different generations behave in this specific environment while buying fashion products online. Since the purchasing power of gene Z is expected to increase over time marketers need to understand their behaviour and adjust company marketing activities according to specific requirements of this generation.

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DO YOUNG CROATIAN CONSUMERS REALLY CARE IF THEY BUY ORIGINAL OR FAKE ITEMS?

Ivana Plazibat

University Department of Professional Studies, University of Split, Split, Croatia
iplazibat@oss.unist.hr

Sanda Soucie

The University of Zagreb, Faculty of Economics and Business, Zagreb, Croatia
ssoucie@net.efzg.hr

Abstract. Globally recognized brands present an ever-increasing opportunity for counterfeiting, especially with the increasing use of digital platforms. Counterfeiting involves goods of inferior quality that are illegal copies of well-known companies' brand names. Nowadays, counterfeiting is a multi-billion-dollar industry that includes pharmaceuticals, foods, fashion, electronics, and other types of products. The literature mostly agrees about the motives and reasons why consumers buy counterfeit items, even knowingly buying fake products, and why some groups of consumers are categorically opposed to counterfeits. The literature also points out the existence of two general categories: deceptive and non-deceptive counterfeits, which are very important in explaining the attitudes of consumers towards such products. The primary purpose of this paper is to explain the advantages and disadvantages of purchasing counterfeit products from the point of view of young consumers whose buying preferences and behaviour rely on mobile devices, the Internet, and social media. The literature mostly considers these consumers as members of Generation Y and Z, but due to their considerable purchasing power, this paper will solely focus on the members of Generation Y. This generation, so-called Millennials' buying behaviour can be described as quick spending as soon as they acquire money and less loyal to brands than previous generations. Millennials use brands to create their images and to be accepted by society. Therefore, for those who can't afford the well-known originals, or who have a negative attitude towards large brand owner companies profiting excessively from high prices, buying counterfeits is an acceptable alternative. The study conducted on a sample of young Croatian consumers shows that they consider the functional benefits of price and accessibility of counterfeits as their advantages compared to originals, while the illegal character and poor quality of counterfeits relative to the authentic ones are their most important disadvantages. The study also points out the increasing popularity of online mediums as channels for selling counterfeits.

Key words: *counterfeiting, young consumers, generation Y, Croatia*

1. Introduction

Although the first publications on the counterfeit business date back to the late 1970s (Staake, Thiesse & Fleisch, 2009) there is still increasing interest in research in that area. The reasons for that we can find in the alarming data on the trade of counterfeit goods. According to the OECD, the global market in counterfeit goods is worth over \$509 billion (EUR460) which corresponds to 3,3% of global trade (Wajsman, 2021). Being an illegal activity, it is not easy to investigate any topic and obtain accurate statistics related to counterfeiting. Moreover, counterfeiting has spread to pharmaceuticals, foods, fashion, electronics, and other types of products, making any effort of its continuous measurement much more challenging.

Due to the complexity of the phenomenon, there is no unique definition of the term “counterfeiting”. In its broadest sense, it encompasses any manufacturing of a product that so closely imitates the appearance of the original product of another to mislead a consumer that it is the product of another (OECD, 1998, p. 5).

Many business conditions create the opportunity for product counterfeiting (Wilson & Kinghorn, 2016), such as the expansion of the global economy, liberalization of the market, the accessibility of the Internet, low risk of discovery, inefficient legal and regulatory framework, etc. Also, the demand side plays a significant role (Eser, Kurtumusoglu, Bicaksiz, & Sumer, 2015) because consumers cannot afford the original brands (Purwanto, Margiati, Kuswandi & Prasetyo, 2019). This is particularly true for younger consumers as the literature (e.g. Francis, Burgess, & Lu, 2015; Swami, Chamorro-Premuzic, & Furnham, 2009) considers them likely to engage in the purchasing of counterfeits. Moreover, this segment of consumers turned to online markets to fulfill their needs, using social platforms, online auction sites, and shopping sites (Berman, 2008) where counterfeit activities grew by around 171 percent between 2016 and 2019 (Federal Research Division, 2020, p. 39). Therefore, in this paper, we focus on younger consumers, particularly the members of Generation Y. The purpose of this paper is to investigate the advantages and disadvantages of purchasing counterfeit products from the point of view of young consumers.

Following the introduction, the paper begins with a literature review on counterfeiting and its impact on different stakeholders. Among works dealing with this topic, a presentation of initiatives in the investigated topics in the EU and worldwide is given. We have to point out that although there is a unified base for customs rules within the EU (Regulation EU No. 608/2013) and the national customs authorities within the member states received more power to deal with the problem of counterfeiting (ECC, 2017) there is still room for improvement. Several member states have already launched a few initiatives to inform the consumer about buying counterfeits. For example, Croatia launched a campaign called “don’t buy a pig in a poke” aiming to raise the awareness of the consumer about counterfeit products sold on the Internet as original products and to inform consumers about all the possible risks and consequences of such purchases, as well as to inform them how to protect themselves from buying such products (ECC, 2017, p. 48). Then, the research methodology and the results of a study among young consumers in the Croatian market are presented. Finally, the paper discusses the theoretical and managerial implications, including the limitations of the study and directions for future research.

2. Literature review

Literature about counterfeiting has addressed different areas. Traditionally, the research has focused on consumer attitudes toward counterfeits of specific types of products such as fashion products (Carpenter & Lear, 2011; Hoe, Hogg & Hart, 2003), pharmaceuticals (Akiny, 2013; Deisingh, 2005; Sholy & Saliba, 2018), software (Butticè, et al. 2020; Lau, 2006), luxury brands (Cesareo, Pastore & Williams, 2017; Francis, Burgess & Lu, 2015; Ting, Goh & Isa, 2016), food (Kendall et al., 2018; Wilson, 2008) where the authors identify the factors influencing consumer attitudes towards, and the intention to purchase counterfeit products with and/or without being aware of their fraudulent character. Namely, depending on the consumers` awareness of buying counterfeits or not, the literature (Ghadge, Duck, Er & Caldwell, 2021; Hieke, 2010)

makes the distinction between deceptive and non-deceptive counterfeits. When consumers are not aware of buying fakes, we consider them to be deceptive counterfeits. Such products are offered on the market as genuine to deceive purchasers and to persuade them to believe in the products' authenticity (Wang, Lin, and Choi, 2020). On the other hand, non-deceptive counterfeits relate to the circumstances when consumers are looking for counterfeit products (Mavlanova & Benbunan-Fich, 2010) and knowingly buy fakes (Wilcox, Kim & Sen, 2009; Koklic, 2011). The fact is that certain circumstances of the purchase (location of the purchase, the price, and the quality of purchased items) leave no doubt about the counterfeit nature of the goods (Viot, Le Roux & Kremer, 2014). According to OECD (2019, p. 35), 58.5% of counterfeit and pirated products traded worldwide in 2016 were sold to consumers who were aware of buying fake products, with the remaining share purchasing unwittingly. The report of the European Union Intellectual Property Office (EUIPO, 2021) shows that on average 9 percent of Europeans claimed that they were misled into buying counterfeits, while 33 percent wondered if the items were genuine.

Besides prominent works on consumers and their counterfeiting purchasing behavior, there are also works on the effect of counterfeits on other stakeholders, such as companies and the public (Buttice et al., 2020; Chaudhry, Cordell, & Zimmerman, 2005; Eisend & Schuchert-Güler, 2006; Hardy, 2010; Wilcock & Boys, 2013). Consumers who expect the original high-quality brand and unknowingly invest money in low-quality counterfeits indirectly could cause negative economic effects. Those unsatisfied consumers may stop purchasing a particular brand thereby lowering its future revenues (Lee, 2011). Buttice et al. (2020) point out that companies that rely more on innovation are more exposed to suffering direct losses from imitation.

In addition to eroded brand value (OECD/EUIPO, 2019), a damaged image, and revenue losses for companies, counterfeiting has caused additional costs such as ongoing investment in loss prevention programs, training, anti-counterfeiting technologies, and measures (Wilcock & Boys, 2013) instead of research and development (Chaudhry, Cordell, & Zimmerman, 2005; Lewis, 2009). Anti-counterfeiting practices ranging from conspicuous packaging to certifications of origin, owned sales channels, or other procedures aimed at monitoring the circulation of counterfeits (Staake et al., 2009) can contribute to lowering the profitability of companies targeted by counterfeiting (Buttice et al., 2020). Yang, Sonmez and Bosworth (2004) synthesize those practices into proactive approaches, but they also mention defensive weapons which allow firms to corporately resolve piracy problems with a commercial settlement, and acquisition. We should add a loss of jobs and tax revenues (Hardy, 2010), for example, the loss of about 300,000 jobs in Europe every year due to counterfeiting practices (Eisend & Schuchert-Güler, 2006). The literature has highlighted the criminal nature of counterfeiting (Chaudhry, Cordell, & Zimmerman, 2005; Wilcock & Boys, 2013) because terrorist networks have organized the manufacture and distribution of counterfeit goods to finance their military operations (EUIPO, 2016, p. 8). Moreover, organized crime groups are heavily involved in counterfeiting, and intellectual property crime is believed to be often complementary to other forms of criminal activity (e.g. money laundering, tax fraud and tax evasion, human trafficking, and occasionally, forced labour) (HKTDC, 2022). Calderoni, Favarin, Garofalo, and Sarno (2014) believe that with increasingly diversified demand for illegal products, mafias such as the Chinese Triads, the Japanese Yakuza, the

Neapolitan Camorra, and the Russian Mafia have gotten the opportunity to increase their profits.

Opposed to that literature, some works are evaluating anti-counterfeiting activities on the market. Among them, we have to mention Schneider and Maillefer (2015) and Farrand (2019) who point out the necessity for effective cooperation between the public and private sectors across borders. Even the US Homeland Security Report to the President of the US (2020, p. 41) notes with concern that despite increased efforts of the Government and private sector stakeholders, the trafficking of counterfeit and pirated goods continues to worsen. The Organisation for Economic Co-operation and Development (OECD) and the European Union Intellectual Property Office (EUIPO) continuously publish a series of reports to develop an understanding of the problem of counterfeiting in the trade context. The EU Commission published the 'New Consumer Agenda' (EPRS, 2021) outlining the legal options available for companies in their fight against counterfeiters. Some international agreements and conventions have set standards for the protection of Intellectual Property Rights under national laws (ITU, 2014). The World Trade Organization (WTO) administered the TRIPS Agreement which set the minimum standards to be applied by all WTO Members to the substantive protections and enforcement of Intellectual Property Rights. The UN Office of Drugs and Crime (UNODC) points out the importance of the United Nations Convention against Transnational Organized Crime and cross-border and multi-sector partnerships in tackling all forms of counterfeiting.

The literature points out the dangerous economic, health, safety, and social impact that counterfeits could have on different stakeholders - manufacturers, consumers, and the public. Therefore, it is interesting to analyze the motives and reasons why consumers still buy counterfeit products, although they are aware of buying fake products which can pose a danger to their health due to their lower quality. Most importantly, the end-users of 80% of the goods reported to be dangerous and counterfeit were children (EUIPO, 2019).

There is the traditional assumption that consumers purchase counterfeit items predominantly because of their low, affordable prices and lower costs compared to purchasing authentic ones (Castaño & Perez, 2014; Furnham & Halldor, 2007; Gentry, Putrevu & Schultz, 2006). However, some authors do not agree (Bian & Moutinho, 2009; Owusu Ansah, 2017; Phau & Dan Teah, 2009) that price determinants are the sole influencing factor causing consumers' purchase intention toward counterfeit goods. Rather, they point out the role of the country of origin. The availability and accessibility of counterfeits in comparison to authentic ones are also reasons for their popularity among consumers (Gentry, Putrevu, Shultz, & Commuri, 2001). Namely, markets and products with unorganized and poorly controlled distribution channels have encouraged counterfeiting (Hanmaikyur, 2019). There is also the consumers' intention to demonstrate that they can afford branded goods (Eisend & Schuchert-Güler, 2006) while preserving purchasing power (EUIPO, 2013) because there are many consumers that do not have the financial means to buy genuine brands (Castaño & Perez, 2014, p. 476). Some consumers, who can afford genuine brands do not believe in spending huge amounts of money on items that soon will not be fashionable due to the relatively short life cycle of a particular type of good (Cesareo, Pastore, & Williams, 2017; Fernandes, 2013). Moreover, some of them have a negative attitude toward large brand owner companies profiting excessively from high prices (Park-

Poaps & Kang, 2018), or just having fun, feeling adventure, enjoyment, and a desire to break the rules (Musnaini, Astuti, Sukoco, & Yacob, 2017; Perez, Castaño, & Quintanillac, 2010; Pratt & Zeng, 2019) and show positive purchase intention towards counterfeits. There is also a vast body of literature focused on enhancing the desired self-value by purchasing counterfeits (e.g. Malik, Merunka, Akram, Barnes, & Chen, 2020; Penz & Stottinger, 2005) which helps consumers with low self-esteem to feel that they belong to a particular social group. On the other hand, Gino, Norton, and Ariely (2010, p. 712) note that counterfeits could make consumers feel less authentic themselves.

3. Methodology

The method used was a survey with a self-administered questionnaire. In line with the study of counterfeit consumption by Francis, Burgess, and Lu (2015), a convenience sample of students, who had experience in purchasing counterfeit products, was chosen for this survey. Data collection was organized in a way that the survey questionnaires were distributed to students of the Faculty of Economics and Business in Zagreb (the time period was August – October 2021) using a Google classroom form. The participants were assured that their responses would be reported, ensuring complete anonymity. In total, 450 responses were collected for analysis in this study, eliminating invalid responses.

The sample included 62 percent of female and 38 percent of male respondents. Respondents that belonged to the 18-23 age group constituted 75 percent, respondents between the age of 24 – 39 had 21 percent, while respondents above 39 held 4 percent of the sample.

Besides questions devoted to the demographics of the sample, the research instrument also consisted of questions about the most frequently bought types of products and the frequency of their purchasing. A five-point Likert-type scale (from 5=strongly agree to 1=strongly disagree) was used to investigate the attitudes of the respondents related to the statements about the reasons and motives for purchasing counterfeits. The study adopted items from Carpenter and Lear (2011), Norum and Cuno (2010).

The collected data were analyzed using SPSS. Besides descriptive statistics calculations, testing the reliability with Cronbach's Alpha coefficient was conducted. The value of 0.80 suggested very good internal consistency reliability for scales used in this research (Carpenter & Lear, 2011). The p values were calculated to examine the level of statistical relationships between pairs of variables. The objectives were obtained using the conventional significance level of 0,05.

4. Results and discussion

Similar to Francis, Burgess, and Lu (2015) we found that more female respondents had purchased counterfeit products (62 percent) and that the largest percentage of respondents (75 percent) belonged to the demographic of 18-23 years old, 21 percent were between 24-39 years old and 4 percent were above 39. Contrary to Kwong, Yau, Lee, Sin, and Tse (2003), demographic variables do not have a significant impact on the respondents' intention to purchase counterfeit products.

The findings about the frequency of purchasing counterfeits are consistent with those of Ha and Lennon (2006) suggesting that the largest percentage of respondents (70 percent) bought counterfeits 1-3 times, while a lower percentage of them bought counterfeits 4-6 times (15 percent of respondents) and 7 times or more (15 percent of respondents), respectively.

Among them, there were gender differences in terms of the frequency of purchasing counterfeit products (Table 1). We can see that there are some differences, although the T-test which was performed showed no statistically significant differences in the means of frequency of purchasing (p-value 0.895) between males and females. In order to investigate whether those differences between age groups are statistically significant, ANOVA tests were performed. However, ANOVA did not reveal any statistically significant differences between the three age groups concerning the frequency of purchasing counterfeits.

Table 1 Purchasing characteristics of respondents in terms of gender and age

		Male	Female	18-23 yrs	24-39 yrs	40 yrs +
Frequency of purchasing CFP	1-3 times	70.9	75.4	43.8	75.0	68
	4-6 times	12.9	13.1	25.0	0	16.0
	7 times and more	16.2	11.5	31.3	25.0	16.0

The respondents were asked about the categories they had indicated that they had purchased in the past year. The results were consistent with previous studies (Miloscia, 2019; The Intellectual Property Office, 2021; Statista, 2022) that found clothing and footwear to be the most favorite categories of counterfeit products bought by the respondents (35 and 28 percent of respondents, respectively). This was followed by accessories, electronics, and beauty products with similar levels of purchasing (12-10%).

In line with the literature (Malik, Merunka, Akram, Barnes, & Chen, 2020), the analysis of the reasons/motives for purchasing counterfeits (Table 2) revealed that for the majority of respondents (85.2 percent) the opinion of others did not significantly concern consumers when they purchased counterfeit products.

Table 2 Reasons/motives for buying counterfeits in terms of gender

	Total (the highest %)	Male	Female
availability	44.4 disagree	19.7	25.9
affordability	42.0 agree	16.0	25.9
social dimension	85.2 disagree	32.1	53.1
similarity to original	61.7 agree	24.7	37.1
good appearance for acceptable value	34.6 undefined	16.1	23.5
overestimated originals	64.2 agree	28.4	35.8
providing benefits as originals	39.5 undefined	16.0	28.4

According to the results in Table 2 and similar to Basu, Basu, and Lee (2015), the similarity to the authentic products and the affordability in terms of price were very important motives for the largest percentage of respondents. At the same time, we have to notice that a large percentage of respondents were not sure that counterfeits provided the same benefits as originals and in their appearance for accepted value.

This leads us to believe that a very large percentage of respondents who showed a negative attitude towards overestimated originals and big business (64.2 percent) are the main reasons for choosing counterfeits instead of originals. If we compare males and females, then we can see (Table 2) that the previously mentioned reasons are more expressed in the case of the female respondents. It is especially evident with the disagreement that low self-esteem and the impact of significant others (Fernandes, 2013) are the reasons for buying counterfeits in comparison to the male respondents.

Table 3 Reasons/motives for buying counterfeits in terms of age

	Total (the highest %)	18-23yrs	24-39yrs	40yrs+
availability of CFP	44.4 disagree	37.0	6.2	2.4*
affordability of CFP	42.0 agree	29.6	11.1	2.4
social adaptation	85.2 disagree	61.7	18.5	4.9
similarity to original	61.7 agree	43.2	16.0	2.4
good appearance for acceptable value	34.6 undefined	27.1	28.4	9.9*
overestimated originals	64.2 agree	49.4	12.3	2.4
providing benefits as originals	39.5 undefined	32.1	8.7	2.4*

Note: * results are opposite to total

The analysis of the reasons and motives for buying counterfeit products in terms of age shows that social influence was more evident with the younger respondents (18-23 yrs old) than in the case of the other two age groups. We have to point out that contrary to the younger respondents, those above 40 years old stated that availability, good appearance for accepted value, and providing the same benefits as original items were the reasons for purchasing counterfeits. It is surprising that again the T-test and ANOVA did not confirm statistically significant differences between the mentioned groups of respondents related to the reasons/motives for buying CFPs, which were reported influential in previously mentioned studies.

To determine the strength and the direction of the relationships between the reasons/motives for purchasing counterfeits, correlation analysis was conducted. In identifying the strength of the relationship Hinkle, Wiersma, and Jurs, (2003) were followed.

Table 4 The strongest correlation coefficients for reasons/motives of purchasing counterfeits

<i>Item</i>		<i>Pearson correlation coefficient</i>
affordability of counterfeits	a good appearance for acceptable value	.501**
	providing benefits as originals	.411**
similarity to original	a good appearance for acceptable value	.635**
	overestimated originals	.711**
	providing benefits as originals	.490**
a good appearance for acceptable value	overestimated originals	.507**
	providing benefits as originals	.591**
overestimated originals	providing benefits as originals	.461**

** Correlation is significant at the 0.01 level (2-tailed)

As Table 4 shows, a moderate positive association was found (with the correlation significant at the 0.01 level) between “providing benefits as originals” and “affordability of counterfeits”, “similarity to original”, “good appearance for accepted value” and “overestimated originals”. These findings are consistent with previous studies by Phau and Teah (2009) and Ting, Goh, and Isa (2016) where consumers justify the purchase

of counterfeits with higher benefits than such products (compared to originals) are providing to them. Moreover, a high positive association between “similarity to original” and “overestimated originals” suggests that the more the counterfeits have qualities like the authentic items, the more consumers are convinced of overestimated and too expensive originals (Phau, Sequiera, & Dix, 2009; Teah & Phau, 2007). We can also say that as counterfeits are more affordable in comparison to originals (in terms of value), the more positive their appearance and value for respondents are, because a positive relationship between the affordability of counterfeits and their appearance was found.

5. Conclusion

Despite its controversial nature and negative impact on different stakeholders in various aspects of the economy, counterfeiting has still recorded steady growth. We can find the reasons for that both on the supply and the demand side. On the supply side, the main reason for being involved in the counterfeit business is the huge amount of money from the manufacture and sale of such items since these are products with low costs of production, a large market share, popular, and in high demand. On the demand side, evident benefits from purchasing counterfeits like affordable prices and lower costs compared to purchasing authentic ones or the enhancement of social value are the most important reasons.

The results of the study conducted among young Croatian consumers confirmed the findings of previous studies about the functional benefits like price and accessibility compared to overestimated originals, as the main reasons for buying counterfeits. Due to the high level of acceptance of counterfeit products among young consumers, this implies that all stakeholders, from producers to retailers, including the national authorities, have to initiate the development of educational programs and media campaigns about the danger of counterfeits. We assume that knowing more about the serious impact on health, safety, etc. could strengthen more responsible behaviour. Some limitations of this paper should be acknowledged. One of the main limitations is the structure of the sample which consisted of students from the selected faculty. Another limitation is the questionnaire with a limited number of items chosen for research. Future research could take quite a few variables to evaluate the various determining factors and achieve more accurate results than before.

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ATTENUATION OF THE NEGATIVE EFFECTS OF THE COVID-19 PANDEMIC ON THE ACTIVITY OF ECONOMIC OPERATORS IN THE FIELD OF HORECA BY PROVIDING FINANCIAL SUPPORT IN ROMANIA

Violeta Urban

George Bacovia University, Bacau, Romania
violeta.urban@ugb.ro

Gabriela-Daniela Bordeianu

George Bacovia University, Bacau, Romania
gabriela.bordeianu@ugb.ro

Andrei-Octavian Paraschivescu

George Bacovia University, Bacau, Romania
andrei.paraschivescu@ugb.ro

Abstract. The COVID-19 pandemic has caused a major shock to the global economy as economic activity has been reduced as a result of direct action by state governments and their decisions to suspend, temporarily close or reduce the work schedule of economic operators, limiting the spread of SARS-VOC-2 virus. One of the areas most affected, since the spring of 2020, has been tourism, public catering and the organization of events, not only because of restrictions imposed by various states, but also because of the fear that has set in among the population (fear of contact the disease, the information about the virus was uncertain, no one knew what was coming and panic had set in). Thus, the destinations of the world were closed one after the other, the airlines were forced by circumstances to cancel the flights, people no longer wanted to go on scheduled trips or could not because of restrictions, no more events were organized and many accommodation units and restaurants they closed. All these problems in the HoReCa sector have forced world governments to adopt certain measures of financial support from national and / or external public funds, such as: measures to support economic operators and to protect jobs, measures to support the economy, measures for the recovery of tourism etc.

Key words: HoReCa sector, financial support, COVID-19 pandemic

1. Introduction

In addition to the multitude of sanitary measures that the Romanian Government was obliged to adopt during the state of emergency (March 16, 2020 - May 14, 2020), respectively the state of alert (May 15, 2020 - March 8, 2022), the adoption of sectoral measures to reduce the socio-economic effects of the COVID-19 pandemic crisis and to revive the economy.

In this context, on February 24, 2021, in the Official Gazette of Romania, part I, no. 186 was published the Emergency Ordinance for the modification and completion of the Government Emergency Ordinance no. 224/2020 on some measures for the provision of financial support for tourism enterprises, accommodation, food and travel agencies, whose activity was affected in the context of the Covid-19 pandemic, as well as on some fiscal measures.

In the whole economy of a country, tourism has a significant contribution to the creation of GDP (in Romania, almost 5%), a special contribution to achieving added value, increasing quality of life and provides over 4% of all employees with individual employment in the country.

Unfortunately, among the most affected sectors of the national economy is the tourism sector, the pandemic affecting the entire chain of this industry: accommodation structures, food structures, travel agencies, guides, etc. This was a consequence of national and global travel restrictions, but also of the uncertainty and uncertainty that characterized the entire period.

Given that supporting businesses is a priority in the economic recovery of a country, the legislative framework has been created so that companies operating in the field of HoReCa can benefit from the state's policies aimed at improving access to financing through state aid schemes, from public funds national and / or external funds.

2. HoReCa State aid scheme

The main objective of the HoReCa State aid scheme is to provide financial support from national and / or external public funds to enterprises operating in the field of tourism, catering and event organization and whose activity has been affected by the COVID-19 pandemic.

The HoReCa scheme is applied throughout Romania, regardless of the development region (Romania is divided into 8 development regions). The entire budget of the HoReCa scheme amounted to 500 million euros, provided from the state budget and / or from external funds.

2.1. Eligibility conditions

The beneficiaries of the HoReCa measure could be the tourist reception structures with classified accommodation functions, catering structures / units and event organizers, licensed travel agencies and certified travel guides.

Eligible beneficiaries are those who do not exceed the ceiling of 1,800,000 Euro state aid in the context of the COVID-19 pandemic, are not insolvent at the time of enrolment in the state aid scheme, are not subject to a decision to recover state aid / minimis (except in cases where the decision has been executed and the claim has been recovered, including the related interest), are not enterprises in difficulty according to art. 2, point 18 of Regulation (EU) no. 651/2014 of Commission Decision, 17 June 2014 (<https://eur-lex.europa.eu/legalcontent/RO/TXT/PDF/?uri=CELEX:32014R0651&from=en>) and submitted the completed financial statements (2019 and 2020).

The obligation of those benefiting from the HoReCa measure is to maintain their activity for which they received funding for at least 6 months from the date of receipt of the first payment of state aid (if the amount of the grant is less than or equal to 200,000 Euros) and 12 months respectively (if the value of the grant is more than 200,000 Euros).

The grants awarded under the HoReCa measure amount to a maximum of 20% of the calculation base in 2020 compared to 2019. The calculation basis, for the beneficiaries who report the turnover, means the difference between the turnover obtained in 2019 and that obtained in 2020, from the eligible activity. For travel agencies, the calculation basis is the difference between the volumes of invoices issued in 2019 compared to

2020 for travel services, including the profit margin. For the beneficiaries who keep records in a single batch, the calculation basis is given by the difference between the receipts obtained in 2019 and those obtained in 2020, from the eligible activity. (<http://www.economie.gov.ro/actualizare-procedura-horeca>)

The maximum amount that a beneficiary can receive through the HoReCa measure is 800,000 Euros. This support can be combined with other amounts received on other support measures, up to a ceiling of 1,800,000 Euros.

2.1.1. Enrolment of beneficiaries in the program

Registration for the HoReCa scheme was done exclusively in electronic format, with applicants initially having 22 calendar days available (June 29, 2021 - July 20, 2021). Due to technical issues, the deadline has been extended by another week, until July 26, 2021.

By July 19, 2021, 8,000 companies were enrolled in the program, and the total value of aid applications was approximately 500,000,000 Euros.

By the end of the enrolment process, 10,185 companies had applied, and the total amount requested far exceeded the approved budget (over 650 million Euros were requested).

Depending on the size of the enterprise, the situation of the requests is as follows (the statistical data presented are processed according to the information published on the website of the Ministry of Economy, in the section dedicated to the HoReCa measure <http://www.economie.gov.ro/schema-de-ajutor-de-stat-horeca>):

Table 1: Size of the requesting company

Type of business	Number of enterprises
Micro-enterprise	6,472
Small enterprise	3,005
Middle-enterprise	650
Large enterprise	58
Total	10,185

According to the county in which the applicant company has its registered office, the situation is as follows:

Table 2: Number of applicants according to the development region in which the registered office is located

Development region	County	Number of enterprises
North-East	Bacău	177
	Botoşani	92
	Iaşi	277
	Neamţ	169
	Suceava	335
	Vaslui	91
Total Nord-East Region		1,141
South-East	Brăila	87
	Buzău	99

Development region	County	Number of enterprises
	Constanța	623
	Galați	150
	Tulcea	69
	Vrancea	95
Total South-East Region		1,123
South Muntenia	Argeș	238
	Călărași	44
	Dâmbovița	102
	Giugiu	33
	Ialomița	45
	Prahova	349
	Teleorman	41
Total South Muntenia Region		852
South-West Oltenia Region	Dolj	222
	Gorj	135
	Mehedinți	81
	Olt	95
	Vâlcea	205
Total South-West Oltenia Region		738
West Region	Arad	219
	Caras-Severin	122
	Hunedoara	252
	Timiș	455
Total West Region		1,048
North-West Region	Bihor	404
	Bistrița-Năsăud	137
	Cluj	727
	Maramureș	285
	Satu-Mare	187
	Sălaj	111
Total Nord-West Region		1,851
Centre Region	Alba	224
	Brașov	570
	Covasna	92
	Harghita	241
	Mureș	340
	Sibiu	395
Total Centre Region		1,862
București – Ilfov region	București	1372
	Ilfov	198
Total București-Ilfov Region		1,570
Total		10,185

Depending on the legal form of the applicants, the situation is as follows:

Table 3: Legal form of the applicant companies

Legal form	Number of enterprises
General partnership	9
Family Business	31
Cooperative society	35
Authorized person	111
Corporation	203
Individual enterprise	222
Limited liability company	9,574
Total	10,185

3. Evaluation of submitted files

In November 2021, the evaluation procedure of the applications submitted under the HoReCa measure was completed. 8,369 companies were accepted in the program, with a total value of 2,144,115,349 lei, i.e. over 434 million Euros. Also in November 2021, the stage of sending the financing contracts to the beneficiaries started.

On November 17, 2021, the payment procedure in the beneficiaries' accounts began. By the end of 2021, payments of 1 billion lei were made, i.e. over 200 million Euros (46.87% of the contracted amounts), and the difference was transferred to the beneficiaries at the beginning of 2022.

According to the county in which the company accepted for payment has its registered office, the situation is as follows:

Table 4: Number of companies accepted for payment, depending on the development region in which the head office is located

Development Region	County	Number of enterprises
North-East	Bacău	142
	Botoșani	73
	Iași	200
	Neamț	138
	Suceava	256
	Vaslui	61
Total North-East Region		870
South-East	Brăila	71
	Buzău	80
	Constanța	532
	Galați	108
	Tulcea	64
	Vrancea	76
Total South-East		931
South Muntenia	Argeș	201
	Călărași	31
	Dâmbovița	74
	Giurgiu	20
	Ialomița	30

Development Region	County	Number of enterprises
	Prahova	290
	Teleorman	27
Total South Muntenia Region		673
South-West Oltenia Region	Dolj	166
	Gorj	102
	Mehedinti	68
	Olt	80
	Vâlcea	174
Total South-West Oltenia Region		590
West Region	Arad	191
	Caras-Severin	113
	Hunedoara	232
	Timis	386
Total West Region		922
North-West Region	Bihor	335
	Bistrita-Nasaud	110
	Cluj	588
	Maramures	250
	Satu-Mare	156
	Salaj	96
Total North-West Region		1,535
Centre Region	Alba	180
	Brasov	447
	Covasna	80
	Harghita	215
	Mures	306
	Sibiu	335
Total Centre Region		1,563
Bucuresti – Ilfov Region	Bucuresti	1,129
	Ilfov	156
Total Bucuresti-Ilfov Region		1,285
Total		8,369

From the data presented in table number 4 it is observed that over 52% of the companies accepted for financing have their registered office in the more developed regions of Romania: Central Region, North-West Region and Bucharest-Ilfov Region. With regard to the amounts attracted by each region, the situation is as follows:

Table 5: Amounts approved under the HoReCa measure, by development regions of Romania

Development Region	Amount
North-East	179,490,401 lei, over 36 million Euro
South-East	194,644,368 lei, over 39 million Euro
South Muntenia	159,966,042 lei, over 32 million Euro
South-West Oltenia	107,045,400 lei, over 21 million Euro

West	166,294,442 lei, over 33 million Euro
North-West	297,112,547 lei, over 60 million Euro
Centre	287,532,585 lei, over 58 million Euro
București-Ilfov	752,029,564 lei, over 152 million Euro
Total	2,144,115,349 lei, over 434 million Euro

Analysing the data from table number 5, it is observed that over 62% of the approved payment amount was attracted by the developed regions of Romania, respectively the North-West Region, the Central Region and the Bucharest-Ilfov Region (with over 35% of the total approved amount) .

The lowest approved amount was 163 lei (33 Euro), and the highest approved amount was 3,940,800 lei (800,000 Euro). 72 applications were declared accepted in the program with the maximum amount (800,000 Euro), of which 50 companies have their registered office in Bucharest.

After the amount of money accepted for payment, the situation is as follows:

Table 6: Amounts approved under the HoReCa measure

Amount	Number of enterprises
Less than 20,000 Euro	4,425
Between 20,001 Euro and 100,000 Euro	2,931
Between 100,001 Euro and 500,000 Euro	876
Greater than 500,001 Euro	137
Total	8,369

4. Conclusions

In the application process for the HoReCa measure, the beneficiaries encountered some problems related to the operation of the online application: some accounting experts or auditors who had to certify the turnover difference for the CANE code with which it applied, were not included in the application database and the beneficiaries had to send an e-mail with their identification data in order to be included in the application, after their verification and validation (action that took several days). Because a lot of e-mails were sent, on June 30, 2021, the e-mail address was blocked and the data was taken to the Call Centre. Thus, it was found that the original database omitted 2500 accounting experts and auditors (these were subsequently introduced following the data submitted by the applicants).

With regard to the expenditure of the support aid, the HoReCa measure did not impose a list of eligible expenses that could be incurred by the beneficiaries, nor did it impose an obligation to draw up a progress report, as in the case of other support measures. However, if the beneficiary registers outstanding obligations to the central tax authority, it undertakes to pay them from the aid granted by the HoReCa measure. This is the only condition regarding the use of the grant.

This state aid was granted in the form of a compensatory measure, so that the money could be used for any expenses in the interest of the company, including salaries, taxes to the local budget, indirect expenses and value added tax (VAT).

References

Legislation:

Emergency Ordinance amending and supplementing Government Emergency Ordinance no. Regulation (EC) No 224/2020 on certain measures for the provision of financial support for tourism, accommodation, catering and travel agencies, whose activity has been affected in the context of the Covid-19 pandemic, and on certain fiscal measures, published in the Official Gazette of Romania, part I, no. 186

Web site:

<https://eur-lex.europa.eu/legal-content/RO/TXT/PDF/?uri=CELEX:32014R0651&from=en>
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<http://www.economie.gov.ro/actualizare-procedura-horeca>

EXPLORING THE IMPACT OF COVID-19 CRISIS ON WOMEN ENTREPRENEURS IN CROATIA

*Katica Križanović, univ.spec.oec.; Ph. D. student
Josip Juraj Strossmayer University of Osijek, Faculty of Economics in Osijek, Croatia
katica.krizanovic@efos.hr*

*Sunčica Oberman Peterka, Ph.D.
Josip Juraj Strossmayer University of Osijek, Faculty of Economics in Osijek, Croatia
suncica.oberman.peterka@efos.hr*

Abstract. The COVID -19 crisis is a current and existing phenomenon that affects all activities in society, changing the way things are done and changing the way of life (even a new word has emerged from it - "new normal").

Entrepreneurial activity in SMEs has been greatly affected by the pandemic due to the general vulnerability of small businesses in general; women entrepreneurs are even more affected because the pandemic has a strong impact on industries/sectors where women are in the majority and because it places an additional burden on family care in addition to job requirements.

According to the Global Entrepreneurship Monitor (GEM), the pandemic has had a more negative impact on female entrepreneurs than their male counterparts. The study found that women were 20% more likely to leave their jobs due to a pandemic (41.9% of women versus 35.5% of men). This has raised fears that the crisis COVID -19 could wipe out years of prosperity for women entrepreneurs. Women represent 51% of the total population in Europe and 51.7% in the Republic of Croatia. Although the percentage of employed women in Europe has increased to 67.3%, in Croatia it is only 60%; only 34.4% of all self-employed in Europe are women. In Europe, women are considered to be the least utilised entrepreneurial and leadership potential.

The aim of this paper is to investigate the impact of COVID -19 on business performance of women-owned businesses in Croatia. We used a qualitative research design to examine the impact of the COVID -19 crisis on women-owned businesses, specifically, we conducted semi-structured interviews.

The results of this study suggest that the challenges faced by women entrepreneurs intensified during the COVID -19 pandemic. In addition, the results have shown and confirmed that the COVID -19 crisis has a strong impact on women-led businesses and also affects the work-life balance potential of women entrepreneurs, but also show that women entrepreneurs are finding ways to continue their businesses.

Key words: COVID-19 crisis, SMEs, business performance, women entrepreneur.

1. Introduction

COVID -19 The crisis is a current and existing phenomenon that affects all activities in society, changing the way things are done and changing the way of life (even a new word has emerged from it - "new normal"). Since the beginning of the COVID -19 crisis until today, a lot of research works are dealing with the impact of the crisis COVID -19 on the business performance. SMEs, specially are under great influence of the pandemic, due to general vulnerability of small businesses. The COVID -19 pandemic

has also shown how profound gender inequalities are, as female entrepreneurs are even more affected because of the pandemic's strong impact on industries/sectors where women are in the majority, and because of the additional burden of family care in addition to job demands. According to the Global Entrepreneurship Monitor (GEM, 2021) and Torres et al. (2021), the pandemic has had a more negative impact on female entrepreneurs than on their male counterparts. Popovic-Pantic et al. (2020) went further in their analysis, claiming that the recent COVID -19 crisis mostly affected female-owned businesses in services, as they were predominant in this sector. The GEM study found that women were 20% more likely to close their jobs due to a pandemic (41.9% of women versus 35.5% of men). This has raised fears that the COVID -19 crisis could wipe out years of prosperity for women entrepreneurs.

Women represent 51% of the total population in Europe and 51.7% in the Republic of Croatia. This balance between man and women is not present in business or political sphere. The percentage of employed women in Europe is 67.3% (compared to 77% of men), in Croatia it is 61,3% (compared to 72,5% of men); only 34.4% of all self-employed in Europe are women and 31,7% in Croatia (World Bank, 2019). In Europe, women are considered to be the most untapped entrepreneurial and leadership potential⁸. About 5% of working-age women in OECD countries are owners of an established business (i.e., a business more than 42 months old), while 3% are owners of a new business (i.e., a business less than 42 months old) and another 5% are actively trying to start a business (OECD/European Union, 2019).

This paper provides new insights into the impact of COVID -19 on the business performance of women-owned businesses in Croatia. Our analysis uses a qualitative research design to examine the impact of the COVID -19 crisis on women-owned businesses. We conducted semi-structured interviews with five women entrepreneurs in order to try to understand how they tackle with influences of COVID-19 pandemic. The paper is organized in three sections. The first section reviews the literature on the potential impact of the COVID -19 crisis on business performance in general and specifically on the business performance of women-owned businesses. The second section of the paper explains the research methodology. The third section presents the results of the conducted research and give conclusions and recommendations for further research.

2. Literature review

In Europe, women are considered to be the most underutilised entrepreneurial and leadership potential. Businesses created and led by women can play an important role in socioeconomic development. The GEM 2020/2021 Women's Entrepreneurship Report showed that women's entrepreneurship is a fundamental promoting factor of inclusive economic growth in developing economies. There are certain differences between ventures initiated and developed by women and those by men. Women entrepreneurs are more likely to develop smaller businesses and rarely established them in partnership. According to the OECD study (2017), women are more likely to start businesses in different industries than their male counterparts - most often in health care, social work, services, trade, and education, as opposed to typically "male" activities such as construction, transportation, and warehousing. Other researchers

⁸ https://eit.europa.eu/our-activities/entrepreneurship/women-entrepreneurship-and-leadership_4/2022

have argued the same. According to Reuschke et al. (2021), the proportion of women relative to men is higher in government, health care, education, and social work (Elam et al., 2019). Marlow and McAdam (2012) also highlight that women in high-income countries tend to start businesses in "crowded" low-value-added sectors and that the majority of women-owned businesses are concentrated in retail and hospitality. According to de Paz Nieves et al. (2021), women-owned businesses were also concentrated in consumer-related sectors (services, hospitality, retail) where the demand shock during the pandemic was felt the most. Torres et al. (2021) argue that the share of women-owned firms is highest in hotels and restaurants (34%) and retail and wholesale trade (30%) industries.

According to the data from the Financial Agency (FINA), women entrepreneurs in Croatia predominate in "the other services sector"⁹, accounting for 58.4% of the total number of entrepreneurs in this sector. Nominally, most women entrepreneurs are in professional, scientific and technical activities. Of the 20,348 enterprises in this sector, 30.8% (6,104) are owned by women, and in another 2,242 (11,01%) enterprises, women share ownership with men and / or legal entities as founders of the enterprise. These sectors are characterised by lower barriers to entry, are highly dependent on consumers as customers (rather than businesses), and are extremely competitive, making them the most vulnerable sectors in most economies. Moreover, in the absence of schooling, childcare, or eldercare services, women entrepreneurs bear the majority of the burden of family care (OECD, 2020). The COVID -19 pandemic disproportionately affected minority and female business owners. This is in part because these businesses tend to be concentrated in the industries most affected by the pandemic, have relatively small financial buffers, and have limited access to multiple sources of funding. Businesses run by women are, on average, smaller and younger than those run by men. They are more likely to be self-funded or funded by friends and family and have fewer financial resources. Women also have less access to external funding and have fewer financial skills compared to men. Women entrepreneurs have fewer professional contacts, including advisory boards or professional advisors, to advise them on managing risks from the pandemic (OECD, 2020 [43]).

Other views predict a greater impact on women's businesses during the crisis COVID -19, not due to family and childcare reasons, but due to the interaction of economic factors and women entrepreneurs' business models (Manolova et al., 2020). There is some evidence that women operate businesses with lower levels of capitalization and rely more on self-financing (OECD/European Union, 2019). This suggests that despite the tendency to adopt more risk-averse business strategies, women-owned businesses may be at greater risk of closure during longer periods of significantly lower or no revenues.

Fear of failure in Croatia is higher among women than men and at nearly the same intensity as in the European Union. However, evidence on the impact of the COVID -19 crisis on women-owned businesses is still limited (Hyland et al., 2021).

⁹ This area includes activities of member organizations, repair of computers and personal and household goods, and various personal service activities (NKD 2007. WITH EXPLANATIONS, available at: https://www.dzs.hr/App/NKD_Browser/assets/docs/NKD_2007_objasnjenja.pdf, 3/2022).

3. Methodology

The aim of this paper was to investigate the impact of COVID -19 on the business performance of women-owned businesses in Croatia. To answer the research questions, we used a qualitative research design and conducted semi-structured interviews with five selected women entrepreneurs from different industries. Since women start entrepreneurial ventures in consumer-related sectors (services, hospitality, retail) that are most affected by economic stagnation (Paz Nieves et al., 2021; Popovic-Pantic et al., 2020; WE Forum, 2020; OECD, 2017; McManus, 2017; Kalnins and Williams, 2014), the selected women entrepreneurs for this study are from these sectors (beauty services, design and marketing services, educational services, motorcycle repair, and business and management consulting). Interviews were conducted in March and April 2022. On average, the interview lasted 45 minutes. Interviews were conducted either via Zoom or at a company's premises. The women entrepreneurs range in age from 33 to 66, are married, and most have a university degree (only one has high school degree).

Interviews were conducted around following questions:

1. *In spring 2020, Croatia was also hit by a pandemic. How has this affected your company - what changes / challenges have affected your work / number of employees, turnover, revenues, suppliers, communication with the environment, work from home, but also possible changes in the way of doing business /, but also the compatibility with private life?*
2. *What strategy do you use to balance work in your company with family demands created by the COVID -19 crisis?*
3. *What measures have you taken to mitigate the impact of the crisis (e.g., reducing activities, downsizing, unpaid leave, days off, reducing work hours, expanding online sales, using government measures to combat the impact of the crisis, etc.)?*
4. *How do you see the crisis - as a new opportunity or as a major threat that has hit your company?*
5. *Have you used government incentives for entrepreneurs to combat the pandemic? If yes, what measures did you take and were they effective?*

All interviews were recorded, and the information was analysed and presented in next chapter. It is not possible to make a generalisation after the qualitative research (and it was not intention in this research), but this kind of research gave us a deeper insight into the studied problem.

4. Findings and discussion

All of the female entrepreneurs interviewed develop their entrepreneurial ventures in the service sector (beauty care, business and management consulting, education, design and marketing, motorcycle repair service and retail). The exception is entrepreneur 3, who is, besides retail in the textile industry also engaged in the production of baby equipment.

Entrepreneur 1, a geodesist by profession, worked at the Cadastre Office in Zagreb for five years and then started her career in the marketing field. She decided to pursue an entrepreneurial career while working at the Cadastre Office in Zagreb, where she very

quickly reached her maximum. Together with her husband, she opened a marketing and design agency in 2009. In the meantime, she graduated from a private business school in Zagreb, where she studied public relations. She is currently studying psychology at the Open University in the UK and describes herself as a passionate fan of psychology. In 2020, she and her friend opened a primary and secondary school with 17 employees. For the past two years, she has been working in education as a primary school principal.

Entrepreneur 2, a serial entrepreneur since she was 18 years old. She was the first in former Yugoslavia to print pictures on T-shirts, the first to open a pizzeria on Korcula, boutiques on the Adriatic coast, wellness, etc. Today she runs a consulting company with two employees. She is focused on giving advice on franchises (buying a franchise or project a franchise as a strategy of growth). She comes from an entrepreneurial family where both her father and mother worked as craftsmen in addition to their regular jobs. Her business is based on a perceived market opportunity.

Entrepreneur 3, graduated with a business degree and post-graduated in entrepreneurship. In 2016, she started to produce and sell children's items (e.g., sleeping bags) and later on, she has widened her product range to products for women and households. Today, she employs two seamstresses. All her life she was surrounded by entrepreneurs- her parents have a successful family business for 30 years.

Entrepreneur 4, has completed three years of studies at the Faculty of Economics, specializing in finance. She manages, administers, sells and markets products in a family company (she and her husband are owners) for the sale and repair of motorcycles, which currently employs four people. She comes from a family of entrepreneurs. She decided to pursue an entrepreneurial career because she could not imagine working for someone else.

Entrepreneur 5, owner of a beauty salon (since 1994) that currently employs 3.5 people. She has always been interested in design, but after graduating from the Faculty of Civil Engineering, she could not imagine working on a construction site with the workers. On the advice of her beautician, she decided to start this business at the age of 22.

All interviewed women entrepreneurs reported that women bear the greatest burden when it comes to fulfilling family and household responsibilities. *"There was a situation where we had to work from home because of the lockdown. For me, it was more difficult to work from home because of childcare, as kindergartens were also closed."* (Woman entrepreneur in the textile and retail industry).

Despite the widespread belief that the crisis COVID -19 had a negative impact on women-owned businesses, particularly in the service sector, the results of our research show that the pandemic did not have a negative impact on the businesses of the interviewed women entrepreneurs. Three out of five women entrepreneurs reported that they maintained the same level of sales and income during the COVID -19 crisis. When asked about the measures taken by the government in response to COVID -19, three of the women entrepreneurs interviewed indicated that they received grants to maintain jobs, and two of them did not take advantage of any government support measures because they did not have a need for that.

All of them used pandemic period for strategic planning and reorganizing businesses in order to stay competitive.

Table 1 Main findings of effects of the COVID-19 crisis on women-owned businesses

	Woman entrepreneur 1	Woman entrepreneur 2	Woman entrepreneur 3	Woman entrepreneur 4	Woman entrepreneur 5
Type of services	design and marketing services, educational service	business and management consultancy services	textile industry	motorcycle repair services	beauty services
Number of employees	10 (design and marketing services); 17 (educational service)	2	3	4	3.5
Number of years that business operate	13 (design and marketing services); 2 (educational service)	4	6	20	28
Effects of COVID-19 crisis on business	No effects on business in design and marketing services; Quick adaptation in the use of digital tools for doing business and communicating with the environment	Increased demand for services; Increased revenue	Increased turnover via web shop; Increased revenue	Reduced supply of goods and materials; Reduced turnover and revenue	Reduced turnover and revenue
Whether were used government policy measures	No	Yes. Government measure to preserve jobs.	No	Yes. Government measure to preserve jobs.	Yes. Government measure to preserve jobs.

<p>in response to COVID-19? If yes, which ones were used and were they effective?</p>		<p>It was effective measure.</p>		<p>The city of Osijek has abolished the utility fee for entrepreneurs. The Croatian Agency for SMEs, Innovation and Investments (HAMAG-BICRO) loans for working capital for micro and small enterprises. It were effective measures, since greatly helped in bridging financial liabilities, but also help in buy and pay goods and prepare for the season.</p>	<p>It was effective measure.</p>
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Source: made by authors

The consequences of the COVID -19 crises for interviewed women entrepreneurs vary and they were not always negative. They can be summarized in three main areas:

(a) The crisis COVID -19 improved the situation of women-owned businesses:

"After the initial shock of the pandemic, micro and small entrepreneurs started to work on strategies and they started to work on business models instead on the operational activities, because the business was closed. This led to the number of domestic franchises increasing by about 20% in 2020 and 2021 compared to previous years."
(Entrepreneur Designer Franchises)

"The crisis COVID -19 did not have a negative impact on the business, as it functioned as a web shop from the very beginning. On the contrary, sales have increased because more people started to do shopping through the web shop, including customers who

previously would have bought exclusively in stores." (Entrepreneur in the textile in retail industry).

b) The crisis COVID -19 did not affect the activity of women-owned businesses:

"The business has not felt the impact of the pandemic, as customers have quickly adapted to the conditions caused by the COVID -19 crisis and have used digital channels for communication. There were also no changes in the financial results of the company." (Entrepreneur in design and marketing services).

c) The COVID -19 crisis has worsened the situation of women-owned businesses:

"The problem caused by the pandemic was the supply of goods and working materials, so we could not work because we had no resources. Fortunately, this did not last long, and after three months the situation began to improve. Also, the problem with the customers was that they did not come to buy our products because of the driving ban. They also did not need motorcycle service because of the driving ban." (Entrepreneur of a motorcycle repair service).

"During the pandemic, the older customers came less, while the younger customers came as usual. As a result revenues decreased." (Female entrepreneur in cosmetic services).

The women entrepreneurs used a variety of strategies to solve the problems caused by the crisis COVID -19. Most women entrepreneurs have resorted to various forms of government assistance (e.g., government measures to preserve jobs, loans for working capital for micro and small enterprises) and have changed their communication to digital channels.

To support women entrepreneurs, the Croatian government introduced two packages of policy measures in response to COVID -19 (as of July 2020). The first package of measures focused on maintaining the financial liquidity of businesses, especially small and medium-sized enterprises. It included 66 measures, including a three-month moratorium on liabilities to the Croatian Bank for Reconstruction and Development and commercial banks, as well as approval of cash flow loans to pay wages and suppliers and restructure other liabilities. In addition, the Agency for SMEs, Innovation and Investment received the increased allocation for ESIF microloans for working capital for micro and small enterprises. Businesses were eligible to receive state support of HRK 4,000 (EUR 520) per month to cover part of the wages of employees employed on March 19, 2020, for three months, with the possibility of extension for another three months. The second set of measures, passed in late June 2020, focused on reducing work hours. Employers could apply for a wage subsidy for their employees if they could demonstrate a 50% decrease in business turnover in May 2020 compared to May 2019. While all existing measures were available to micro, small and medium enterprises, the last one applied to companies with more than ten employees (OECD, 2020).

5. Conclusions

Women entrepreneurs are important for the global economy and the development of societies. Although there are certain differences between male and female entrepreneurs, both have the same goal - to keep their business active and competitive.

The crisis caused by COVID -19 has affected female entrepreneurs more than their male counterparts, mainly because of the industry in which female entrepreneurs are the majority and because of the difficulties in balancing personal and professional life. Despite these differences, women entrepreneurs do not give up and find ways to keep their business going.

Our research confirmed above mentioned - COVID -19 the crisis and lock-downs have affected women entrepreneurs in Croatia, but it also shows that women entrepreneurs have adapted to the crisis situation in different ways. They have either taken advantage of different types of state support, started digitizing their activities (e.g., switched their communication to digital channels, increased online sales, etc.), used the time for strategic thinking and restructuring the business in order to maintain the competitiveness of their companies. The research also showed that government support is very important and that it should perhaps be designed specifically for women-led businesses.

The shortcoming of the conducted research are that it only reflects to the short-term consequences of the pandemic and focuses on a limited number of women entrepreneurs from two regions of Croatia. It would be interesting to conduct research over a longer period of time to see how the crisis COVID -19 affects the business performance of women-led businesses in the long term and to include women entrepreneurs from all parts of Croatia and from different sectors.

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BOOSTING THE PROCESS OF SMART SPECIALIZATION IN THE REPUBLIC OF MOLDOVA

Șavga Larisa

Trade Co-operative University of Moldova, Chisinau, Republic of Moldova
savga.larisa@gmail.com

Baran Tatiana

Trade Co-operative University of Moldova, Chisinau, Republic of Moldova
taty.ady@mail.ru

Abstract. Nowadays, innovation has become an extremely important policy imperative for all countries involved in building a knowledge-based society. As a catalyst for economic growth, research and innovation, it is identified as a generator of solutions to overcome any challenge. Increasing the role of innovation in enhancing economic competitiveness, as well as the need to strengthen cooperation between academia and business environment are desiderata contained in a number of policy documents.

Analysis of the legislative and policy framework, situation in the field of research and innovation and economic development in the Republic of Moldova reveals certain deficiencies, including the fragmentation of the system and the national policy for research and innovation to the detriment of a systemic and integrated approach; insufficient interaction of innovation policy with other national, regional, local and sectoral policies; priorities and goals of strategies are not convergent, they are mostly limited by their own areas of action; development policy is insufficiently focused on capitalizing on the competitive potential based on innovation, on the synergy of resources that can ensure economic growth; regional development focuses mainly on infrastructure development; the allocation of resources for research, development and innovation is fragmented and based more on institutional research capacity than on the needs of the real sector of economy, which generates gaps in cost and benefits, etc.

In such a context, there is an urgent need to change the paradigm of economic development, rethink the system of research, development and innovation (RDI) and regional development and identify opportunities for economic transformation based on innovation. An effective solution in this regard is economic growth and competitiveness through smart specialization, which is considered an innovative strategy for economic transformation at local/regional/national levels.

While in the EU countries the development and implementation of smart specialization strategies have become a prerequisite for demonstrating positive results, in the Republic of Moldova this process is in its infancy and requires enhanced efforts from all stakeholders in accomplishing this approach.

The paper analyses trends in research, development and innovation in the Republic of Moldova, the challenges it faces, the actions taken in the context of developing the smart specialization strategy and identifies future goals for innovation-driven economic transformation.

The development and implementation of the Smart Specialization Strategy in our country will play an essential role in regional development, increasing competitive economic advantages, by identifying new niches of innovative specialization or by integrating new technologies into traditional industries and exploiting their „smart” potential. This will facilitate the transformation of the republic’s economy into a knowledge-based economy, competitive, sustainable and integrated into international value chains.

Keywords: innovation, economic growth, entrepreneurial discovery, smart specialization strategy

1. Introduction

Sustainable economic development of the national economy of any country can be ensured through economic transformations based on innovation. Today, innovation is one of the key priorities of the long-term European regional policy reform project and plays a key role in generating growth and creating more and better jobs. Without innovation, companies would not be able to diversify their offer in the market (due to a diversified content of the assortment and high quality), modernize processes, services and increase their added value.

Sustainable economic development and sustainable growth depend more and more on the potential for innovation and the transformation of each country's economy in terms of adapting to an ever-changing and increasingly competitive environment.

2. Approach to scientific research

Significant progress in economic development, as well as efficient use of factors of production and productivity are possible only if the research potential is fully utilized to develop a knowledge-based economy. Smart specialization is a tool to help achieve this goal, significantly contributing to the improvement, ultimately, of the well-being of society.

The Republic of Moldova currently continues to show significant gaps in competitiveness at the level of the main elements that determine the competitive potential. Important discrepancies appear, first of all, in terms of research, development and innovation.

In 2020, research and development activities were carried out in 61 institutions, including 39 research institutes and centers, 15 higher education institutions and 7 other types of institutions or organizations. Of the total number of organizations engaged in research and development activities, 48 (or 78.7%) are state-owned.

An important factor is investment in research and innovation. In 2020, in the Republic of Moldova, expenditures on carrying out research and development activity amounted to 469.6 million lei, which is only 0.23% of the Gross Domestic Product. Per capita spending on research and innovation in the country is around 8.4 Euro compared to 660 Euro, allocated at the EU-27 level in 2018 (Eurostat-Statistics Explained, 2020). The largest share falls on current expenses - 95.4%, while capital expenses account for only 4.6%. By type of research activity in 2020, 75.2% of total current costs were directed to applied research, 10.6% to basic research and 14.2% to technological development.

It is clear that, in order to be competitive, an economy must have skilled workforce, a developed infrastructure, an efficient innovation system, and an economic and institutional system that supports this approach. Therefore, in the situation in which increasing economic competitiveness is a priority for the Republic of Moldova, the goal of developing an innovative economy should also be a priority.

Since gaining independence, the Republic of Moldova has focused its economic policy on ensuring sustainable and lasting development, by adopting a regulatory, policy and institutional framework in this area, aimed at increasing the innovation potential of the

country. Analysis of the legislative and policy framework, of the situation in the field of research, innovation and economic development of the Republic of Moldova highlighted certain deficiencies, among which:

- fragmentation of the national science and innovation system and policy to the detriment of a systemic and integrated approach;
- insufficient interaction of innovation policy with other national, regional, local and sectoral policies;
- priorities and goals of these strategies are formulated very broadly, they are not convergent and are limited, for the most part, by their own sectors of action;
- there is a lack of well-defined research niches for technological specialization and concentration of financial efforts;
- development policy is insufficiently focused on the realization of competitive potential based on innovation, on the synergy of resources that can ensure economic growth;
- development policy is developed according to the “top-down” principle; involvement of stakeholders, especially business environment, is minimal, and, as a rule, is limited to consulting the developed documents, but not involvement in the development process;
- regional development is focused mainly on the development of infrastructure and not on economic development based on innovation and use of economic growth potential;
- allocations of resource for research, development and innovation are fragmented and based more on institutional research capacity than on the needs of the real economy sector, which generates cost-benefit gaps;
- actions provided in the strategic documents are in many cases declarative in nature, etc.

Considering this, through the National Program for Research and Innovation for 2020-2023, approved by the Decision of the Government of the Republic of Moldova (no. 31 of 01.08.2019) (National Program for Research and Innovation for 2020-2023, 2020), it has been proposed to implement a set of measures aimed at optimizing the processes occurring within the research and innovation system, increasing its transparency, social impact and economic relevance.

This Program also proposes to adopt and transpose the principles of smart specialization. Thus, the specific goal 1.2 *Determining the niche of smart specialization of the Republic of Moldova to promote research based on excellence in strategic areas of relevance and impact on the economy and society* within the framework of the Program, provides the following:

- carrying out the entrepreneurial discovery process,
- approval of strategic priorities for areas of research and innovation for 2023-2027, in accordance with the identified niches of specialization,
- identification of areas for which it is necessary to create new research centers.

As a result of initiating the implementation of the National Program for Research and Innovation for 2020-2023, in 2020 there was a slight increase in research and development activity compared to 2019, which did not reach the level of 2018. Thus,

in 2020, as in the previous years, most researchers worked in the natural sciences (33.9%), and the fewest researchers in the humanities (8.2%). At the same time, in 2020 there was a decrease in the share of researchers in natural sciences (by 2.9 pp compared to 2019), in engineering and technological sciences (by 2.5 pp), and in humanities (by 1.3 pp), while the share of researchers in agricultural sciences (by 2.9 pp), social sciences (by 2.2 pp) and medical sciences (by 1.6 pp) increased.

An assessment of trends in the provision of resources, primarily human resources, for the research, development and innovation sector of the Republic of Moldova notes, with regret, a decline in the human potential involved in this activity. Thus in 2020 (NBS, 2020) research and development activity has involved 4052 persons (of which 2907 persons or 71.7% were researchers), compared with 4451 in 2018 (researchers - 68.6%) and 5114 in 2010 (researchers - 63.4%). Depending on the number of researchers per one million population of the country, we note that according to this indicator, the Republic of Moldova registers an indicator more than five times below the EU average (3994 people), amounting 696 persons in 2018 (724 persons in 2017, 662 persons in 2015) (The World Bank, Researchers in R&D, n.d).

An important role in product/process/activity innovation is played by business involvement in innovation and research activities. In terms of economic activity, in the Republic of Moldova 98.6% of the total number of enterprises is micro, small and medium enterprises (SMEs). In 2020, the largest share of SMEs (20.5 thousand enterprises or 35.7% of all SMEs) was engaged in trade. The productivity of SMEs in the Republic of Moldova, measured as value added per employee, is estimated at 7932 Euros, less than one-fifth of the average of 43604 Euros in the case of EU SMEs (Small Business Act Fact Sheet, 2019).

In order to assess the evolution of the development of small and medium business sector in the Republic of Moldova, relevant data on recent innovation activity were used. According to the National Bureau of Statistics (NBS, 2019) for 2019-2020, the number of innovative enterprises has amounted to 448 units and constituted 12.6% of the total number of enterprises involved in research (a decrease of 26% compared to 2017-2018). Of the total number of innovative enterprises, 50% carried out several types of innovations simultaneously (products, processes, methods of organization and marketing), 17% carried out product and/or process innovations, 34% carried out innovations regarding methods of organization and/or marketing.

From the total number of 448 innovative enterprises, 49% were engaged in industry (of which 45% in the manufacturing industry) and 51% in service sector (of which 22% in wholesale trade and 14% in information and communications, 7% in transport and storage).

It is interesting to analyze the data on the registration of inventions. According to the Report of the State Agency on Intellectual Property (SAIP Report 2018, 2019, 2020), 254 patent applications were filed in 2020 (0.4% more than in 2019 and 8.1% more than in 2018).

Similarly, in 2020, 133 titles of protection were issued (2.2% less than in 2019 and 28.1% less compared to 2018). The largest share falls on the requests in the field of current human necessities (42.8%), being followed by chemistry and metallurgy (36.6%), the least requests were registered in the field of mechanics, lighting and heating - 7 (out of 254) or 2.7%, electricity - 2 (0.8%). In 2020, national applicants

have submitted only 85 patent applications and 152 for short-term patents.

According to the World Bank data (The World Bank. Patent applications, residents, n.d.), in 2019 in the Republic of Moldova, 85 patent applications per million population were registered, which is 7.6% less than in 2018, while in other countries this index was more than high (Romania - 881, Poland - 3887), the average for EU countries being 88889 submitted applications.

The trends of recent years in the field of research, development and innovation have influenced the position of our country in the international rankings. According to the World Intellectual Property Organization, with regard to the Global Innovation Index (GII, 2020), the Republic of Moldova ranked the 59th place out of 131 countries monitored in 2020. At the same time, according to other studies and the Global Competitiveness Report (GCR, 2020), the Republic of Moldova ranked 86th out of 141 countries in the Global Competitiveness Index in the 2020 world rankings.

The analyzed situation draws attention to the low degree of cooperation between the representatives of different sectors in the innovation value chain, especially between research institutions and business environment. The value chain from “knowledge” to “marketing (sale)” is completely fragmented due to the lack of tools available to support common partnerships between research and the business environment.

Undoubtedly, in terms of smart specialization, innovation plays a key role in providing that much-needed impetus to economic growth, thus, being one of the key priorities of the regional policy reform project for the coming periods.

The experience of the European Union countries demonstrates the significant impact of the implementation of smart specialization strategies that enhance synergies between different Community policies (national, regional), boost public and private sector investment, as well as the efficient use of European structural and investment funds.

At the same time, smart specialization has been an integral part and an ex-ante conditionality of the European Cohesion Policy, resulting in more than 180 smart specialization strategies developed by the Member States and their regions, namely in 19 EU Member countries and 7 non-EU countries, as well as 187 EU and 18 non-EU regions. At the European level, more than 67 billion euros are allocated from European structural and investment funds, as well as from national and regional sources in order to support the development of such strategies (S3 Platform, 2017).

Although the existence of a Smart Specialization Strategy is not a conditionality for the countries outside the European Union, in 2016, the Joint Research Center of the European Commission (JRC, 2017), through the Smart Specialization Platform (S3 Platform, 2017), launched a pilot project to assist with methodological expertise the relevant institutions of Serbia, the Republic of Moldova and Ukraine in the process of developing RIS3 (S3 Platform/S3 beyond EU, 2017).

In the pilot project of the JRC for countries included in the European Enlargement and Neighborhood Policy, the Republic of Moldova benefited from the support of European experts to map the economic, scientific and innovative potential of the country, and to initiate the process of developing the strategic framework for smart specialization.

Following the activities carried out in the context of developing the Smart Specialization Strategy of the Republic of Moldova (mapping the economic, innovation and scientific

potential, identifying preliminary priorities for smart specialization), nationwide workshops on entrepreneurial discovery were organized in 2019 and then in 2021; they were attended by 353 persons in two rounds, including 58 representatives of public authorities, 117 persons from universities and research institutes, 120 businessmen and 58 representatives of the civil society. The workshops identified the following potential areas of smart specialization (Support for the entrepreneurial discovery process in the Republic of Moldova, 2019):

- **Energy:** energy efficient technologies, alternative energy sources, heating solutions.
- **Information and communication technologies ICT:** micro/nanomaterials and electronic engineering, interoperability, open data and e-Infrastructures, software engineering, Mobile apps, cloud computing.
- **Agriculture and food processing:** advanced biotechnologies for agriculture, sustainable agriculture, value-added food products.
- **Biomedicine&Biopharmaceuticals:** biomedicine, biopharmaceuticals, bioinformatics&ehealth.

At the same time, within entrepreneurial discovery workshops project ideas have been identified that would contribute to the achievement of the identified goals for each sub-area of the four identified areas of specialization.

The results of the entrepreneurial discovery process play a critical role in the development of smart specialization strategy, as they have allowed the verification and specification of the priority areas of smart specialization based on the consensus of all stakeholders.

The elaboration of the Smart Specialization Strategy is the next step in the implementation of the concept of economic development based on innovation. Its importance and the actions to be followed are established in the Association Agreement between the Republic of Moldova and the European Union and the European Atomic Energy Community and their Member States, ratified by Law no. 112/2014 (Law for the ratification of the Association Agreement between the Republic of Moldova and EU, 2014), in the Action Plan for the implementation of the Association Agreement between the EU and the Republic of Moldova for 2017-2019 (Section IV, Chapter 24, Article 129), approved by Government Decision no. 1472 of 30.12.2016 (Government Decision, 2016), in the Action Plan of the Government for 2020-2023, approved by Government Decision no. 636/2019 (National Program for Research and Innovation for 2020-2023, 2020), as well as in the activity plan of the Ministry of Education and Research of the Republic of Moldova.

At the same time, according to the National Development Strategy of Moldova 2030 (Draft of Moldova NDS 2030, 2020), the main mechanism for increasing the income levels and reducing poverty and its impact is the development of the country's competitiveness both internally and externally, including through smart specialization. Thus, the following priority actions are identified in this regard:

- empowerment of young entrepreneurs through technical advice and financial support programs, including by setting up a mechanism for providing innovative young small businesses with access to the public procurement market;
- development of innovative policies, programs and services that facilitate the

channeling of remittances into investments through the development of financial savings tools and programs that encourage the investment of remittances in the productive sectors of the economy;

- improve the efficiency of economic processes by increasing the companies' potential to innovate and implement innovations, including through the formation of clusters, hubs and industrial parks, as well as stimulating private investment in research and development, as well as partnerships between companies and educational institutions in this field;
- capitalizing on the investment and innovation potential (skills, abilities, networks, know-how) of immigrants by simplifying immigration and investment procedures in the national economy.

Given these benchmarks, the working group created by the Ministry of Education and Research of the Republic of Moldova (which includes one of the authors of this study - L. Șavga) with the support of JRC, national and foreign experts developed the draft of the first Smart Specialization Strategy of the Republic of Moldova for 2022-2030 "SMART MOLDOVA-2030".

The goal of the Smart Specialization Strategy (Draft of the Smart Specialization Strategy of the Republic of Moldova for 2022-2030, 2022) is to create in the Republic of Moldova a dynamic research and innovation ecosystem, closely linked to the entrepreneurial environment, with permanent transversal communication mechanisms to quickly and comprehensively reflect the results of scientific research and academic training in the field of competitiveness of business environment and economic performance of the country, offering solutions to societal challenges.

Therefore, the implementation of the Smart Specialization Strategy of the Republic of Moldova will contribute to ensuring a smart, sustainable and inclusive economic growth, but also to mitigating the challenges facing the society of the Republic of Moldova. Linking the research and innovation potential with the existing knowledge repository within the entrepreneurial environment will increase the competitiveness of the economy of the Republic of Moldova and will capitalize on existing and emerging opportunities to connect to international value chains.

The aim of elaborating the Smart Specialization Strategy of the Republic of Moldova is to become a country with a knowledge-based economy, competitive, sustainable and integrated in the international value chains, with a resilient, digitalized and innovation prone society by 2030.

To achieve the proposed approach, the overall goals of the strategy were defined, among which:

- Strengthening cooperation between the business and research sectors.
- Increasing the competitiveness of the national economy by developing innovative entrepreneurship and related innovation culture.
- Widespread use of innovations to alleviate societal issues.

The following have been highlighted as specific objectives (Draft of the Smart Specialization Strategy of the Republic of Moldova for 2022-2030, 2022):

- conducting joint RDI activities based on 4 identified smart specialization priorities;
- developing RDI infrastructures, related to S3 areas;

- developing human resource skills in the field of innovation, smart specialization and innovative entrepreneurship;
- supporting innovative activities in the business environment;
- improving cooperation between the participants of the Quadruple Helix;
- internationalization in the areas of smart specialization by connecting to regional and European platforms and value chains.

The implementation of the strategic objectives will help to concentrate public investment in research and innovation and create synergies/prevent fragmentation between different support and investment instruments. This goal is extremely important, given that the Republic of Moldova allocates only 0.23% of GDP to finance RDI activities (while at the EU level this indicator is on average 2.2%).

At the same time, this will facilitate the improvement of competitiveness of small and medium-sized enterprises by developing internal innovation potential.

An important aspect is to increase the involvement of stakeholders in the process of identifying research priorities, which should be established on the basis of a bottom-up process of entrepreneurial discovery. Entrepreneurial discovery, respectively the participatory process through which the niches of smart specialization are defined, requires the involvement of actors from the business environment, research institutions, public organizations and civil society in an active dialogue.

The expected result of the implementation of this strategy relates to technological diversification and the transfer of research results into practical activities, which would boost the innovation of products, services, processes, etc.

The revitalization of traditional sectors of the economy or their modernization, through higher value-added activities, as well as penetration into new market niches, the introduction and dissemination of innovative technologies in regional SMEs are results that the implementation of S3 can offer.

As a result, new forms of innovation will be explored and exploited, such as user-centred innovation, social innovation and service delivery innovation, with all the beneficial consequences derived from it.

The activities launched under smart specialization will not only open the way for the implementation of a number of individual research and innovation projects, but will also facilitate market access and positioning of innovative products, which will increase economic competitiveness at the local, regional and national levels. In turn, this will lead to an increase in national financial resources directed to research and development, including, as well, the private sector.

In the long run, the Republic of Moldova will gain real competitive advantages by identifying new niches of smart specialization, by integrating new technologies into traditional industries and using their “smart” potential.

3. Conclusion

Smart specialization belongs to a new generation of research and innovation policy. Smart specialization strategy takes into account not only the typical aspects of research and skills, but also all the strengths of a region (such as geographical location, population structure, climate, natural resources), combined with demand-related issues (e.g. societal needs, potential customers, public sector innovation). Given that

smart specialization strategies are an empirical condition for cohesion in the European Community, directing financial resources to the region according to real needs and potential is a smart solution for economic transformation at local/ regional/national levels.

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THE MARKET AS A FACTOR FOR VALORIZATION OF THE TOURIST RESOURCES - THE CASE OF MACEDONIA

Katerina Angelevska-Najdeska

Faculty of Tourism and Hospitality, Ohrid, Macedonia
katerina.angelevska@uklo.edu.mk

Elena Cickovska

Faculty of Tourism and Hospitality, Ohrid, Macedonia
elena.cickovska@uklo.edu.mk

Abstract. The tourist market is unique in its specificity and differs significantly from any other type of market of goods or services. However, it is still based on a combination of supply and demand as integral parts of that market. When researching and analysing the tourist supply and demand, special emphasis is placed on the attractive elements - resources, services, and prices. The attractive elements of the market or the tourist resources are objects or phenomena of natural and anthropogenic origin that attract tourists, enabling them to meet the basic tourist needs, i.e. their cultural and recreational needs. The attractiveness of resources is a very variable category under the influence of various factors, but the specificity of the objects of supply and demand in the tourist market should be especially emphasized. In the effort to achieve successful development of tourism, the movement of tourist demand is of great importance. Crucial are the factors that influence the demand and cause changes in the wishes and needs of potential tourists and their expectations for resolving those demands. The complexity of the tourist needs, which is manifested in each individual as a need for a certain combination of basic and additional services, must be satisfied with a complex tourist product, which implies temporal and spatial synchronization of attractive, communicative and receptive factors. Valorization is an integral part of market research and cannot be done independently of the research of the relationship between supply and demand, unlike some other markets of goods and services, between which an optimal degree of correspondence should be established. Since the are at a certain, this should be taken into account In the tourist valorization of resources and in tourist market research the seasonal character of the tourist trade and the spatial distance between tourist supply and demand should be taken into account. Given the specificity, complexity and heterogeneity of the tourist market and especially its spatial and temporal variability, then it is clear that it is impossible to apply a single method in researching the tourist market. Therefore, it is best to combine different methods in order to attain accurate results and a valid assessment of the dimension of the tourist demand perspective.

Key words: *tourist valorization, tourist resources, tourist market, tourist offer, tourist demand*

1. Introduction

The valorization of the tourist resources with the help of the market mechanism imposes the need to analyse the wishes and needs of the potential tourist-tourist demand on the one hand and the needs of the entities that are on the side of the tourist offer, i.e. those who participate in the creation and realization of the tourist product. Various factors influence the formation, as well as the change in the needs and desires of potential tourists. When determining the price of tourist resources, all factors that can influence its change are analysed, in order to be able to influence the demand for

those resources, but also to be competitive. The future valorization of tourist resources on the market, their exploitation and preservation for future generations depends on several non-market laws, the time period of preparation and adjustment of tourist resources to create a new tourist product, as well as the formation of completely new preferences of future participants at the tourist market.

For the successful development of tourism, the continuous monitoring of the tourist demand, but also of the tourist supply is of special importance. It actually means monitoring the expected changes in the wishes, needs and expectations of modern tourists, on the one hand, but also monitoring the opportunities for their anticipation and satisfaction on the other hand.

2. Characteristics of the tourist market in Macedonia

The market covers the relations between supply and demand, which actually means a form of exchange of products or services mediated by money. The market is a set of entities that need certain products or services, but at the same time have the ability and authority and are willing to buy those products or services.

The tourist market, in terms of its constituent elements, does not differ from other markets of classic products, because it also has its subjects, namely: tourist demand and supply, exchange facilities (products, services) and the price. (Milisavljević, 1998)

The tourist market is a set of supply and demand relations that are aimed at the exchange of goods and services through money and on a scale that determines the price of the goods or services. (Marković & Marković 1972) However, with the functioning of these components the specifics of this market is shown.

The modern concept of the tourist market must respect the integrity and causal connection of the three basic categories of the tourism phenomenon - movement, space and consumption. (Jovicić, et al., 2005) Because, in the tourist market, supply and demand refer to both goods and services and neither is dominant, the characteristics and research of this market differ significantly from the general concept of market.

The tourist market is heterogeneous and consists of different groups of consumers, which are characterized by different needs, different purchasing power, different perception of a certain type of tourist offer and different reactions to the means of tourist propaganda.

The subject of tourist demand is not only goods or only services. These are in fact the tourist resources, which in themselves have neither the quality of goods nor the quality of services, but as attractive elements make the tourist market specific. (Lancaster & Massingham, 1997)

Resources with higher tourist value should offer better service, and thus have a higher price. However, attractiveness is not the only, and often not the most important measure of the tourist value of resources. The primacy of the attractive elements in the market structure indicates the close interrelationship of supply and demand, which is much more pronounced compared to other types of markets.

When analysing the attractiveness of resources, we should always keep in mind the fact that they should be used without utilization, i.e. we should be aware that excessive use of resources can impair their attractive properties. (Angelevska-Najdeska, 2009)

Services are part of the tourist market that are closely related to the location and characteristics of the attractive elements. Only on the tourist market there is a unification of traffic and catering services in the form of a tourist arrangement. In the tourist market it is impossible to conduct a separate research on the demand for traffic services without linking them to the demand for certain resources.

The connection of the attractive elements and the catering services is significant, and is reflected in the type, capacity and category of the accommodation facilities. Before starting the construction of certain buildings, the appropriate segment of tourist demand should be carefully studied and care should be taken to preserve the style of authentic architecture so that it can be maximally fit into the natural landscape environment, but also to not disturb the ecological balance.

In Macedonia, each city has its own specific architecture for which it is recognizable, which is a reason to take more care of its preservation. (E.g. Ohrid, Krushevo, Kratovo, Debar, etc.). For example, Ohrid is a city protected by UNESCO primarily because of its specific architecture. And that is why we must not allow what happened to the city of Dresden in Germany to happen again. Namely, due to ignoring such issues, this city is no longer under UNESCO protection. (Angelevska-Najdeska, 2006)

Prices are directly related on the one hand to the attractiveness of resources, and on the other hand to the quality of services. The relationship between resources and services is two-way. Namely, most often in the areas with attractive resources are built accommodation facilities of a higher category, and vice versa, such facilities affect the increase of the attractiveness of resources. In addition to the type of resources, the price is influenced by market factors, the distance and size of urban centres, the density of the same or different resources at a particular location and so on.

The price of the tourist product as an integral product of the tourist destination is formed according to certain criteria and under the influence of certain factors. (Bakić, 2002)

One of the specifics of price formation is that it is formed at a higher level in those destinations that are more attractive (rich in cultural and historical monuments, natural resources, etc.), and in buildings that are more modern and contemporary equipped (of a higher category). Nevertheless, when setting the price, care should be taken not to lose market competitiveness. It is also particularly important to find the most appropriate way to combine pricing policy and quality policy, which means that reducing the price should not reduce the quality of the tourist product, or vice versa by increasing its quality not to abruptly raise the price.

3. Characteristics and trends of the tourist demand and supply

The continuous monitoring of the trends in the tourist demand, i.e. monitoring of the expected changes in the wishes, needs and expectations of the modern tourists, and in the tourist offer, monitoring of the possibilities for their prediction and satisfaction, is necessary for the development of tourism. (Angelevska-Najdeska, 2008)

a) Specifics (characteristics) of the tourist demand

The basic condition that has to exist for the demand for a product or service to appear is, above all, the existence of a need. When it comes to tourist demand as a specific type of demand, in addition to the existence of the need and the readiness to address that need with a particular product or service, also free time and free cash is needed. (Milenković, 1999)

When it comes to selling a tourist product of a destination the potential consumer has to come to the destination to consume the product and it leads to the conclusion that, it is concluded that to do so one must first have enough free time and enough free funds to cover the costs of that trip and stay in the tourist destination. The fund of free time and the amount of free money depend on many factors (economic development of the country, the level of employment of the population, etc.), and are a basic and unconditional factor for tourist consumption. (Kobašić & Senečić, 1989)

When analysing the situation in Macedonia in terms of this issue, then first fact is the really high unemployment rate. This problem initiates the emergence of other subsequent problems. The part of the population that belongs to this group (of the unemployed) should have more free time, but additionally face the problem of securing financial resources. So they are burdened with meeting some other more essential needs, and the tourist needs of the ranking of this group of population are in the lower half. The working population also does not have the conditions to meet their tourist needs because the amount of free money is either very small or they do not have it at all, and they also do not have enough free time. (In Macedonia they do not have enough free days at work and do not have vacations, although they are guaranteed). When all these factors are taken into account, it is concluded that if this population wants to be included in tourism flows, then it will probably be included in domestic tourism, which has a certain positive feature, because in that way the domestic population gets a better opportunity to get to know his country. This fact should be taken into account by travel agencies when forming their offer. (Angelevska-Najdeska, 2006)

b) Specifics (characteristics) of the tourist demand

In order to successfully meet the different tourist needs, it is necessary to create a complex tourist product, i.e. to make temporal and spatial synchronization of attractive, communicative and receptive factors. These factors cover a wide range of elements that tourists expect to have at their disposal, so that with their choice and consumption they can achieve personal satisfaction.

The relative immutability, i.e. the consistency of the attractive factors, as well as the relatively high fixed costs for the communicative and receptive factors contribute to the relatively slower turnover of funds in this business. Thus, state intervention is not only welcome, but also necessary in order to stimulate the private sector to invest in this area, in terms of incentives in the field of credit policy to tax policy (Bakić, 2003). Amortization of the rigidity of the offer of the tourist destination, i.e. its product, can be achieved if the services are constantly and variously combined and, by introducing certain attractions that will attract the attention of tourists and increase the attractiveness of the destination. All the previously mentioned elements determine the inelasticity of the tourist offer, and are also relevant factors for strategic management of the tourist product, which, in turn, must be supported by applying a relevant strategy to the other elements for market performance.

The tourist offer is established in the tourist destination where the tourist resources are located. In order to consume the tourist product, it is necessary for the consumer-tourists to come to the tourist destination. From this fact arises the characteristic of the non-transferability of the elements of the tourist offer.

Another characteristic of the tourist offer is the inability to store services. This means that the tourist destination does not face a problem when the demand is constant, but problems are encountered when the demand is unstable or changeable. (Kobašić & Senečić, 1989)

These characteristics of the tourist offer, with the previously exposed specifics of the tourist demand, prove the complexity of the tourist market, but also indicate the necessity of managing the marketing activities at both micro and macro level.

In order to take measures to create a better quality tourist offer that will adequately respond to tourism demand, a research was conducted. In the research, tourists were surveyed in order to analyse their opinion on the attractiveness of the destination and the use of tourist opportunities.

The first Figure shows the opinion of tourists about the use of tourist opportunities in Macedonia as a tourist destination.

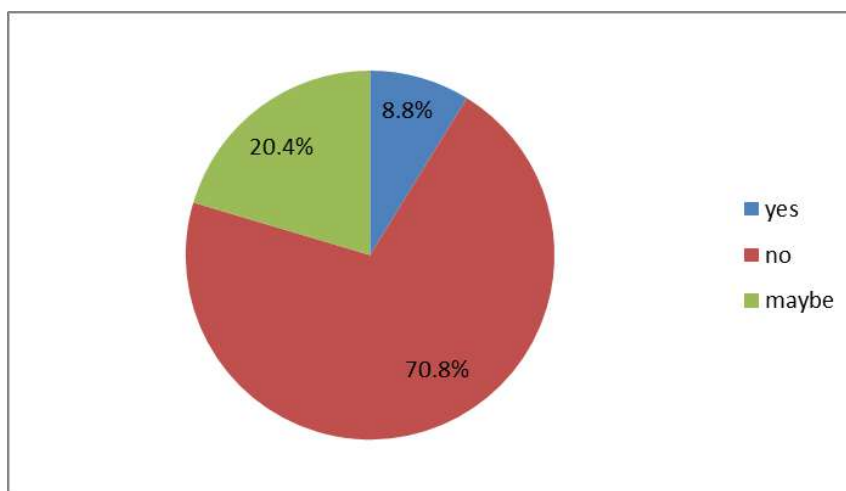


Figure 1 Perceived utilization of tourist opportunities

The results show that the percentage of respondents who think that tourism opportunities are not used at all is really high, and when we add to that percentage the number of respondents who think that tourism opportunities are not used enough, it is concluded that there is opportunity to undertake countless activities in order to take advantage of the tourist opportunities and to enrich the tourist offer.

Figure 2 shows how tourists assess the attractiveness of the space in various tourist destinations in Macedonia.

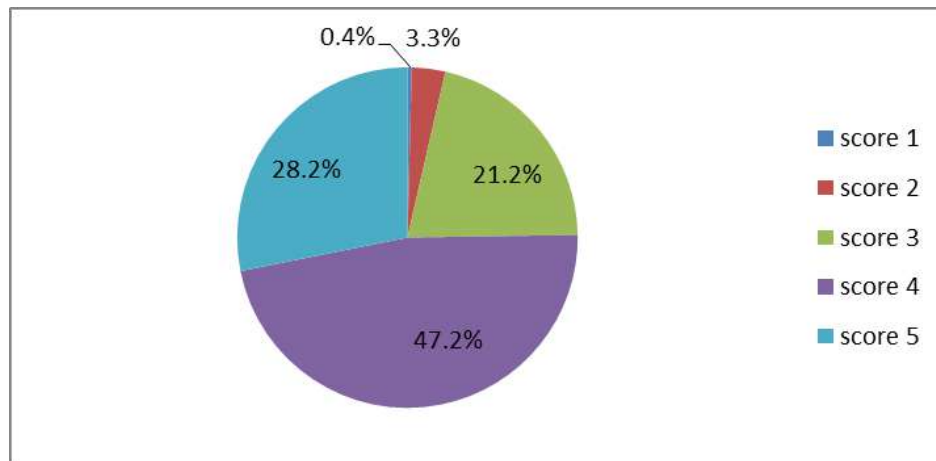


Figure 2 The attractiveness of the space where tourists stay

The results presented in the graph show that there is a large percentage of respondents who rated the attractiveness of the space with a score of 5 and a score of 4, which means that there are huge opportunities to undertake various activities that will contribute to the development of tourism and improve the position of the destination on the market.

4. The market as a factor for valorization of tourist resources

When the tourist market is treated as a factor for valorization of tourist resources, it can be considered locally, regionally, nationally, internationally and globally. Namely, the local market covers the excursion movements, and the world market refers to the resources that have world value, such as Paris, London, Madrid, Rome, New York, the Alps, the Mediterranean, etc. In both the local and the world market the services can be of the highest category, which means that the prices should be equal. Unlike the classic product, the product of the tourist destination, if one strives to reach the world demand, must take into account the impact of the resources on the quality, but also on the price. With increasing of the spatial distance of certain areas or segments of demand the prices of services in tourist areas increase too (due to the cost of transporting customers).

If the place of the offer is closer and more attractive, then the arrival of potential tourists is more probable, which means that the geographical location of the tourist destination and its traffic connection with the initiative spheres is of great importance. The market value of the offer, i.e. the tourist resources is directly related to the attractiveness of the resources, and inversely related to the distance to the consumer centres (tourist areas). (Angelevska-Najdeska, 2009))

When researching the tourist market, one usually comes across data that can dimension the shape and structure of demand. The tourist season as a distinct market category directly covers the supply and demand, which emphasizes the need for their combined study.

Given the fact that tourist consumers as a specific type of consumers use the resources and services that are part of the destination offer, it is logical that in market research first should be investigated the volume and structure of the offer. In that way the demand of potential tourists can also be influenced or modified. This is even more

important when it comes to attractive elements that, if valorized, can be included in the tourist offer, and with the necessary investment of labour and funds should participate in the completion of certain services. (Angelevska-Najdeska, 2017) For that purpose, the research emphasized the priorities for tourism development. Graph 3 presents the results.

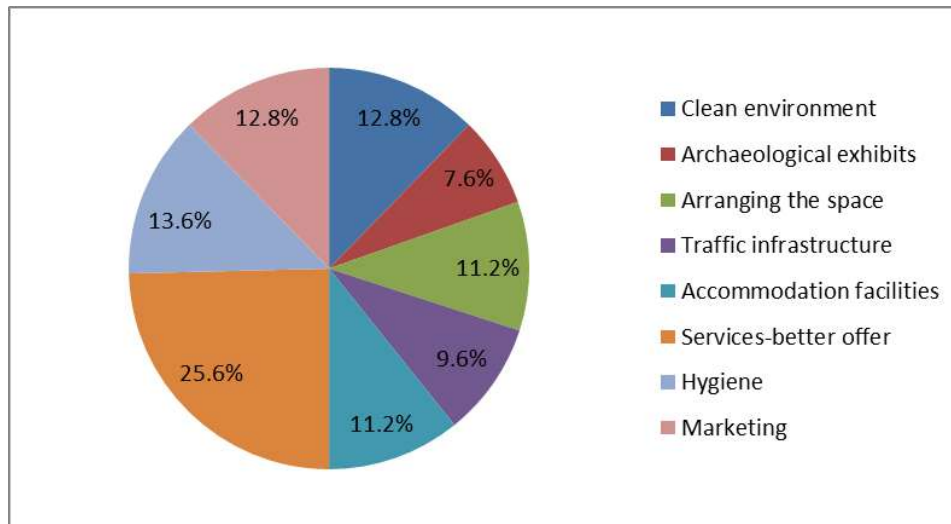


Figure 3 Tourism development priorities

Figure 3 shows that the greatest attention should be paid to services, because the largest percentage of respondents believes that they are the most important for intensifying tourism development. Therefore, all activities should be taken in order to increase the range of services included in the tourist product of the destination, because it affects the increase of the quality of the tourist product on the one hand, which in turn affects the attraction of tourists and encouraging the development of tourism, on the other hand.

5. Impact of geographical elements and space on the formation of tourist supply and demand

The length of the road and the time spent on the trip influence the decision in which parts of the receptive zone the tourists will move. When forming the tourist demand, the attractiveness of the resources of the receptive countries or regions should first be determined and evaluated. The attractiveness increases with the improvement of the accessibility to a certain destination on the one hand, and on the other hand with the modernization of the means of transport, which in turn affects the reduction of the travel time, but also the extension of the residence time. (Milenković, 2003)

The value of the resources affects the spatial approximation or distancing of supply and demand. For example, depending on whether we are talking about international or domestic resources, we can mention the example of Disneyland, which attracts people from all over the world, and some local attractions, i.e. resources, such as the event in the village of Dolneni, or the monastery of St. Jovan Pretecha in the village of Slepche-Demir Hisar, attract only the local population.

The spatial distance of supply and demand is the distance between the emitting and receptive areas. When making efforts to reduce that gap between supply and demand,

the minimum travel time must be taken into account, as this is often a decisive factor in choosing a destination. The maximum time of the tourist trip is the time of departure, the trip, the optimal rest and the complete acquaintance and experience of the receptive space.

The Republic of Macedonia is a crossroad in the Balkans and is accessible by almost all means of transport, except maritime traffic. This is important because tourists make decisions based on the lowest costs (length of road, type of vehicle, length of travel, strength of attractiveness of the destination). Tourist destinations that are closer to the emitting countries have a greater attractive force than the distant ones. Macedonia is relatively close to the emitting areas, but does not have an adequate level of quality of the other conditions that are important for successful tourism development (economic development, unstable political system, level of tourist service ability). The traffic connection with the most attractive and most important tourist resources is very bad, which is one a reason more for reducing the quality of the offer. On the other hand, having in mind the fact that we should look for potential foreign tourists at a distance of about a hundred kilometres from our country, which means to consider a closer environment and neighbourhood as a potential market, we have more opportunities for different regions in the country. For example, tourists from Kosovo were very frequent this year in Popova Sapka, at Kozuv tourists from Bulgaria and Greece, in Krushevo and Pelister tourists from Albania and Greece. This information is of great importance, on one hand for directing research to tourist demand, and on the other hand for creating the tourist offer. (Angelevska-Najdeska, 2009)

Potential tourists, at the moment when they have to make a decision to choose a certain destination, often feel certain psychological constraints, as a result of the distance of the receptive countries, the unavailability and the limited choice of means of transport. These are factors that have a discouraging effect on travel decisions for those destinations. A discouraging factor is also the length of time it takes to get to that destination, as they do not want to spend part of their free time on a long trip to the desired destination. This can only be mitigated by the extremely high attractiveness of receptive areas. The high cost of travel, as a result of the length of the travel that entails additional costs for food, accommodation, fuel i.e., have also a negative impact on decision-making. Certain activities can be undertaken in order to minimize the negatives, like organizing travels that take less time, or by increasing the quality of all accompanying road conditions.

If the spatial distribution of supply and demand is of a broken nature, i.e. if the tourist resources of the destination on the one hand, and the emission centres on the other hand, are distributed in an area with a larger radius, then the costs of transporting tourists increases, which certainly has an impact on the choice of destination.

Try to provide good quality figures, as you would wish them to look when published. Do not use embedded vector graphics because of possible side effects. Use raster graphics in a resolution not less than 300 dpi. Try to balance the figure size according to information you are trying to present to reader. Allow a small percentage of figure resizing for the sake of typesetting.

6. Conclusion

The complexity of the tourist needs, which is manifested in each individual as a need for a certain combination of basic and additional services, must be satisfied with a complex tourist product, i.e. an offer that implies temporal and spatial synchronization of attractive, communicative and receptive factors. These factors indicate a wide range of numerous elements that tourists expect to have at their disposal, so that with their choice and consumption they can achieve personal satisfaction.

Given the fact that tourist consumers as a specific type of consumers use the resources and services in the tourist destination that are part of the offer of the destination, it is logical that in market research should first understand the volume and structure of the offer and thus can influence the modification of the demand of potential tourists.

This is even more important when it comes to attractive elements that if valorized can be included in the tourist offer, and with the necessary investment of labour and funds should participate in the completion of certain services. When researching and analysing the tourist supply and demand as integral components of the market, special emphasis is placed on the attractive elements - resources, services, but also prices.

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THE IMPACT OF THE BOARD GENDER DIVERSITY ON THE DIVIDEND POLICY

Ivica Kusić

Ministry of Finance, Tax Administration, Split, Croatia
ivica.kusic@gmail.com

Željko Požega

Faculty of Economics, Osijek, Croatia
zpozega@efos.hr

Abstract. Dividend policy is one of the basic and most important corporate policies in which the management of the company decides on dividend payment and payment pattern (behavior of dividends) over a certain period of time. The decision to pay or not pay a dividend is a key financial and economic decision for both business managers and owners and investors. The theoretical literature based on corporate management indicates that gender diversity on corporate boards can affect not only the regulation and control of board activities, the results of the enterprise and the quality of financial reporting, but also the dividend policy. The aim of this research is to analyse whether the board gender diversity influences the determination of dividend policy, and if it does, to explain in what form and in what way that influence will occur. The research is performed by analyzing static panels on a sample of Croatian manufacturing companies listed on the Zagreb Stock Exchange (ZSE) that operated between 2015 and 2019. To conduct such an analysis, the study uses several variables related to the characteristics of the board, including the proportion of women on the board, the false variable of whether the female sex is present on the board of directors, the Blau index and the size of the board of directors. Also, the survey includes net profit margin and natural sales logarithm as variables that are specific to the profitability of the enterprise. When it comes to gender diversity, the results reveal that the Blau index, as index measuring the heterogeneity of the board of directors, has a statistically significant negative impact on the amount of the dividend. This confirmed the main hypothesis of this scientific paper: Greater gender diversity of the management of the enterprise has a negative impact on the amount of dividends.

Keywords: gender diversity, management, dividend policy, sales, ZSE

1. Introduction

The decision to divide profit into a portion that will be paid to shareholders through dividends and on the part that will be reinvested in the company is one of the most difficult, but also strategically most important decisions for the survival and growth of the enterprise in the future. Since the partial payment of of the profit and the company's growth is important to shareholders, such a decision is not only difficult but is also a conflict one, for these two goals are mutually opposed because a higher dividend payment will mean less money for retained profit and investments in growth, and vice versa, higher retained profits will mean that shareholders participate less materially in the successful business of the enterprise. Ultimately, retaining the full amount of profit puts shareholders in a situation where they have no investment return on their assets and hypothetically puts them in a position of misinvestment and loss of interest. What is clear when looking at the data on the operations of the largest companies in any

world market is the fact that the tendency of the policy of stable dividends prevails, what means that management of the companies decide to stabilize both the payment of dividends and amounts per share regardless of the movement of revenue and profit, because the decrease or increase in the amount of dividends per share follows a delayed time lag when the management of the enterprise is shown after a year or even more that revenues are stable fallen or steadily grown. In simpler terms, dividends tend to rise late related to profit growth and vice versa, dividends fall late relating to the fall in profits. In contrast, the company's boards also have at their disposal a policy of a constant payback ratio, whereby a constant percentage of profits are paid, and as profits vary, the amounts of dividends certainly vary. The residual dividend policy prioritises internal investment opportunities over the payment of dividends. In any case, the dividend policy is a significant tool of corporate management, a motivational investment factor and represents a mean of creating an image of the enterprise.

Many studies recently deal precisely with gender diversity in the boards and supervisory boards of enterprises, and many researchers are trying to answer the question of the correlation between gender diversity and the performance of the company's business or with the way the company is run.

2. Literature Overview

The dividend policy represents a payment policy implemented by management, where management indicates (determines) the size and pattern of cash payments over time. Dividends, although the subject of many researches, are still one of the most interesting and intriguing topics in modern financial literature. This is confirmed by Brealy and Myers (2005) in the early 21st century when they rank dividends among the ten most important unresolved issues in modern finance.

One of the key issues when it comes to dividends is what exactly determines the size of dividend payment. Many have tried to answer this question primarily because companies pay large sums of money to their shareholders. One of the fundamental papers on the topic of dividend policy, the work of Merton Miller and Franco Modigliani (1961), has prompted various studies on the motives and consequences of dividend policy. The basic assumptions of their theory are the absence of market imperfections such as taxes, transaction costs and information asymmetry. According to their theory of irrelevance of the dividend policy, it has no effect on the share price or the cost of capital, which means that the value of the company will be independent of the dividend policy adopted by the management. Most economists believe Miller and Modigliani's conclusions (1961) are correct, given their assumptions about a perfect and efficient capital market. However, no one claims that their model gives an accurate description in the real world. The real world has a number of factors influencing the dividend decision.

By the end of the 20th century, many theories and explanations were developed that sought to clarify how dividend policy is determined. According to the theory of signaling, the change in dividends should be a signal of current or future profitability that should move in the same direction as the change in dividends. According to the theory of dividend policy and the hierarchy of capital structure authored by Mayers (1984), companies will first try to finance their investments from realized profits as the cheapest source of financing for companies. If it does not make a large enough profit, the

company will be financed by loans and issuing new shares. Jensen and Meckling (1976) developed the theory of agency costs. In the context of this theory, dividends reduce cash funds under the control of managers, creating the need for management to turn to the capital market in order to get the money which's needed to finance planned investments. In such a situation, the management is placed under the control of the capital market and reduces the need for the owners to supervise the management. Jensen's (1986) free cash flow theory is just another variation of the agency's cost theory. The theory of free cash flow emphasizes that paying dividends or increasing dividends actually means reducing management's ability to misuse the company's money. The theory of the lifecycle of the company is based on the view that, as the company matures, the ability to generate money goes beyond the ability to find profitable investment opportunities. Each of the dividend theories developed so far explains the dividend policy by specific factors. However, there is no single academic consensus on which theory is most acceptable and which best explains dividend policy. Researchers are constantly engaging and testing new theories to scientifically contribute to understanding dividend policy.

Theoretical literature based on corporate management shows that gender diversity on corporate boards can affect the regulation and control of management activities, the performance of enterprises, the quality of financial reporting, and on dividend policy as well. Several studies present a finding that suggests that men and women behave differently in the workplace, especially when it comes to money and finances (Krishnan & Parsons, 2008). Women are less likely to engage an unethical behavior in the workplace in order to receive financial rewards. (Bernardi & Arnold, 1997)

While the importance of gender diversity in various aspects of corporate life, including management, is unquestionable, its financial benefits are not entirely clear as empirical research to date has yielded ambiguous results.

Gender diversity attracted the attention of many scientists to find out its impact on various aspects of the company's activities. Welbourne (1999) found out that companies with a higher percentage of women in top management perform better business results as measured by Tobin's Q ratio.

Krishnan and Parsons (2008) showed that earnings quality (the degree to which reported earnings reflect the economic reality of the company) is positively and significantly related to high gender diversity in senior management.

Marinova et al. (2016) examine the impact of board diversity on performance measured by the market performance measure, namely tobin's Q ratio. As for the gender diversity of the board, the authors use two measures, the proportion of women in management and a false variable stating whether at least one woman is present in management. The authors found no link between board diversity and company performance.

Kiliç and Kuzey (2016), studying the impact of gender diversity on corporate performance in Turkey, found a positive impact of the presence of female directors on the performance of companies using ROA, ROE and ROS variables. The authors use three variables to measure the gender diversity of a board consisting of a false variable to indicate whether at least one woman is present on the board, the proportion of women in management positions and the Blau index.

Pucheta-Martines and Bel-Oms (2016) also researched the impact of the gender diversity of boards of directors on dividend policy in their paper. They assumed that

the share of independent, institutional and executive directors and the percentage of shares they hold on the board of directors influenced the dividend policy of Spanish companies. Their results showed that the share of female directors and the proportion of shares held by directors is positively linked to the payment of dividends, while the percentage of institutional directors has a negative impact on the payment of dividends. The percentage of independent and CEO directors has no impact on the payment of dividends. Their results suggest that gender diversity on boards benefits shareholders through its effect on dividend policy and provides evidence of factors affecting dividend policy.

3. Research methodology

The main premise of paper is that due to differences between men and women in workplace behavior and their differing views on finances and money, greater gender diversity on company boards will lead to low payment of dividends.

The research is performed using the sample of Croatian manufacturing companies listed on the Zagreb Stock Exchange (ZSE) that operated between 2015 and 2019. A total of 9 manufacturing companies were included in the research, in which a total of 45 observations were given.

Thompson Reuters' database and financial statements were used to calculate the variables used in the study. Some variables should have been calculated while some variables were directly taken from the database and financial statements.

The dividend per share variable (**DPS**) was taken into the research of the variable representing the dividend policy. The **DPS** variable also represents a dependent variable in the study.

As for the characteristics of the management board, board size variables and gender diversity variables were used.

The size of the board (**Bsize**) is calculated as a natural logarithm of the number of board members.

The share of women on the board (**Bshare women**) is calculated as the number of women directors on the board of the enterprise in relation to the total number of board members.

The paper uses a dichotomous, false variable (female dummy variable) to determine whether the board of directors is characterized by certain attributes where variable 0 means that there are no women and variable 1 if at least one woman is a member of the board of directors.

A heterogeneity index such as the Blau Index (BLAU) is also used in this study. Board of directors Blau Index is a heterogeneity index widely used in studies dealing with board diversity (e.g. Campbell and Mínguez-Vera, 2008 and Abad et al., 2017), where it's calculated as:

$$Blau\ index = 1 - \sum_{i=1}^n P_i^2 \quad (1)$$

where P_i is the percentage of female directors and n is the total number of board members in the firm. The index values can range between 0 and 0.5 at which there is

the same percentage of male and female board members and thus the diversity is increased (Blau, 1977).

Net profit margin (**NPM**) and natural sales logarithm (**Ln sales**) as variables specific to corporate profitability are also included in the survey. NPM is calculated as net profit over revenues.

4. Research results

Descriptive statistics for all variables used in the study are listed in Table 1. Descriptive statistics are calculated on the basis of 45 observations for all variables.

Table 1: Descriptive Statistics.

Variable	Obs	Zn.	Std.Dev	Min	Max
DPS	45	20.23	30.55	0.00	125.00
Bsize	45	1.10	0.64	0.00	1.79
Bshare Women	45	0.26	0.33	0.00	1.00
Female dummy variable	45	0.58	0.50	0.00	1.00
BLAU	45	0.17	0.20	0.00	0.50
NPM	45	3.21	4.77	-11.51	14.81
Ln Sales	45	20.80	1.18	18.93	23.84

Source: Author's calculation

The first step in the study was to check the problem of multicollinearity between independent variables. The Matrix of Pearson's correlation coefficients was implemented to test the problem of multicollinearity. The correlation matrix for independent variables is shown in Table 2. The absolute value of the Pearson coefficient greater than 0.7 indicates a strong correlation between independent variables and as can be seen there was no problem of multicollinearity between independent variables.

Table 2: Correlation Matrix.

	Bsize	Bshare Women	Female dummy variable	BLAU	NPM	Ln Sales
Bsize	1					
Bshare Women	-0.5028	1				
Female dummy variable	0.0616	0.6762	1			
BLAU	0.4903	0.1047	0.7454	1		
NPM	0.0292	0.2808	0.3128	0.2194	1	
Ln Sales	0.4333	-0.0837	-0.1942	-0.1589	0.1305	1

Source: Author's calculation

For the purpose of econometric data analysis, a static balanced panel data analysis was employed. Model (2) forms the basis of the assessment.

$$Y_{it} = c + \sum_{k=1}^K \beta_k X_{it}^k + \varepsilon_{it} \quad (2)$$

Where:

Y_{it} is a dividend per share (DPS) of the company i , at the time of t , with $i = 1, \dots, N$; $t = 1, \dots, T$

X_{it} are k independent variables as mentioned in the research methodology.

The study used a static panel with fixed effects (**FE**) and a static panel with random effects (**RE**). Hausman's test showed that the most appropriate model is a static panel with random effects (**RE**). The Breusch-Pagan test was used to detect heteroscedasticity problems in the study, and showed that problem of heteroscedasticity was present therefore robust standard errors were used in model which are shown between parentheses. Table 3 presents the results of the analysis.

Table 3: Parameter estimates of static panel model with random effects.

Variable	DPS
Bsize	-1.455147 (-11.93022)
Bshare Women	4.312607 (-26.82788)
Female dummy variable	27.00274 (-18.78789)
BLAU	-81.99388*** (-30.77797)
NPM	1.601059 (-1.341493)
Ln Sales	13.43502** (5.20372)
Cons	-265.4495*** (99.76998)
R2 inside	0.0955
R2 between	0.8972
R2 Total	0.6266
Model p-value	0
Hausman's specification test	chi = 4.23
	p value = 0.6459
Breusch-Pagan test heteroscedasticity	chi2 = 20.31
	p-value = 0.0000

*, **, *** Statistically significant at; 10%, 5%, 1% level, respectively. Robust standard errors are located between parentheses.

Source: Author's work

The model of a static panel with a random effect is statically significant (the p-value is 0.000), and turned out to be the correct choice. Table 3 shows that variable BLAU has a statistically significant negative impact on DPS, while Ln sales have a positive and statistically significant impact on DPS. This confirmed the hypothesis of this scientific paper that the amount of dividends per share is negatively impacted by the greater gender diversity of the management of the enterprise. Also, research has shown that the sale of the company has a positive impact on the amount of dividends that can be expected.

5. Conclusion

Research in this paper has shown that gender diversity on corporate boards can influence dividend policy. The most important findings of the research are that the sale of the company has a positive impact on the amount of dividends that can be expected, and that the heterogeneity of the company's management has a statistically significant negative impact on the amount of the dividend. In other words, if the company has a greater diversity of management, the company will pay a smaller amount of dividends. The selected sample proved to be one of the main limitations of the research, and at the same time as a guideline for further analysis that would include a larger sample of companies on the Zagreb Stock Exchange, which would make the results of the research more valuable.

When it comes to the gender diversity of management and its impact on both the business performance of the enterprise and the dividend policy, a large number of studies are certainly expected in the near future that will try to prove the stable persistence of the correlation and the direction of this correlation. However, regardless of the results of the research, the common goal of all developed countries remains to encourage and ensure a greater share of women in all management structures both in the economy and in politics and in other spheres of life. The growing trend of the share of women on the boards of companies exists, but it is insufficiently strong and fast. The problem of inequality, i.e. the underrepresentation of women in leading managerial positions, continues to exist in many countries of the world and it is the task of each society to encourage the implementation of active measures in order to improve the situation. This is an issue that is unusually important not only because of gender equality and discrimination reduction of women, but also for the better, more consistent and successful management of business systems.

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REVIEW OF AVAILABLE FINANCING SOURCES AND IMPROVEMENT POSSIBILITIES FOR CRAFTS BUSINESSES IN CROATIA

Martina Tomasović

*University Department of Professional Studies, University of Split, Croatia
mtomasovic@oss.unist.hr*

Antonija Roje

*University Department of Professional Studies, University of Split, Croatia
ababic@oss.unist.hr*

Slađana Brajević

*University Department of Professional Studies, University of Split, Croatia
brajevic@oss.unist.hr*

Abstract. Crafts are one of the most common forms of entrepreneurial activity in Croatia. According to the official statistics of the Croatian Chamber of Trades and Crafts, in June 2021, there were 94.317 active crafts in Croatia. In recent years, regardless of the situation with the COVID-19 pandemic, the number of open trades in Croatia has increased the most in small and medium-sized towns. The reason for this are certain advantages of opening crafts businesses such as: ease of business opening, simple bookkeeping, business control, more favorable tax model, etc. However, the most pronounced disadvantages are limited sources of funding, and general perception of business instability. This paper shows the role of the Ministry of Economy and Sustainable Development, and the Croatian Chamber of Trade and Crafts, as members of the institutional infrastructure whose duty is to support craftsmanship in Croatia. Furthermore, the aim of this paper is to summarize the available financing sources and incentives of crafts in Croatia, both by institutions and organizations within the country, as well as by available European Union funds. Therefore, the main tasks are defining specific areas within the crafts sector that need to be improved, and to conclude whether the available financial and professional support is sufficient for sustainable craftsmanship business development in Croatia.

Key words: *crafts, financial sources, funds, entrepreneurship*

1. Introduction

Crafts business shall refer to permanent performance of permitted economic activities in accordance with Article 8 of the Crafts Act, by natural persons for achieving income or profit generated by production, trade, or provision of services on the market. A legal person performing an economic activity determined in the list referred to in Article 6, paragraph 2 of this Act, if it conducts practical classes and apprenticeship performs a craft. Craft industry is one of the outstanding industries and not only it can absorb the larger sales force compared with the larger industry, but it can also provide the most significant contribution to GDP. Reijonen and Komppula (2004) in their paper state that for craft entrepreneurs, product quality and other subjective meters are more important indicators of success than more traditional, hard criteria (profit). Marketta Luutonen (2007) published in their survey that high quality of the products is the main factor of

success of craft entrepreneurs. Image, company or product image is mentioned as the second most important success factor, interesting is that these findings are still valid.

Following types of crafts businesses in Croatia are distinguished: free crafts businesses (only the general conditions for crafts registration required), associated crafts businesses (exam on vocational training, appropriate secondary school qualifications or master craftsmen's examination required), privileged crafts businesses (crafts businesses which can be run exclusively on the basis of the privilege certificate issued by the competent ministry or other body).

Two or more natural persons can run a crafts business together with the objective of performing economic activities. Natural persons can mutually run an associated crafts business provided one of them, apart from the general conditions, meet the special condition of vocational qualifications, adequate secondary vocational education or passed the master craftsman's exam. The mutual relations between two persons shall be regulated by written agreement and the regulations referring to partnership provided for by the General Obligation Act (Portal of the Trades and Crafts Register of the Republic of Croatia).

The craftsman is liable for all obligations arising in the performance of trades with all his property. Enforcement for realizing a monetary claim against a craftsman may not be carried out on those things and rights on which it could not be carried out against him, if he would not perform economic activity, and on those things and rights necessary for performing his economic activity, if it is his main source of livelihood. Enforcement for realizing a monetary claim against a craftsman may not be carried out on real estate in which the debtor lives, to the extent necessary to meet the basic housing needs of the debtor and the persons he is legally obliged to support. If the creditor, on the basis of a voluntary legal transaction with a craftsman, has acquired a lien or similar right on the real estate referred to in paragraph 3 of this Article to secure the claim whose enforcement he seeks in that case, the craftsman as a debtor may not oppose such enforcement (Article 36, Crafts Act, 2013).

In 2016, the latest amendments to the Small Business Development Stimulus Act were published, which regulates the basis for the implementation of economic policy incentives aimed at development, restructuring and market adjustment of small businesses, and the establishment of the Croatian Agency for SMEs, innovations and investments (HAMAG-BICRO). Incentive measures and activities are there for achieving the goals of small business development.

Holders of the implementation of small business development measures in the sense of this Act are: Ministry, HAMAG-BICRO, units of regional and local self-government, Croatian Chamber of Commerce, Croatian Chamber of Trades and Crafts, Croatian Employment Service, Central Bureau of Statistics, Croatian Association of Cooperatives, associations of small business and entrepreneurship, legal entities established to encourage small businesses (Small Business Development Stimulus Act, 2016).

According to all the above, the aim of this paper is to identify specific financial measures and incentives, as well as professional-educational support that the institutional infrastructure holders are obliged to provide to crafts businesses, regardless of whether the financial support is provided through the government budget (and local self-government units), or by resources available through EU funds.

2. Statistical overview of crafts and trade

The most important statistical data related to the craft and trade sector in the period of the last three years is shown in Figure 1.

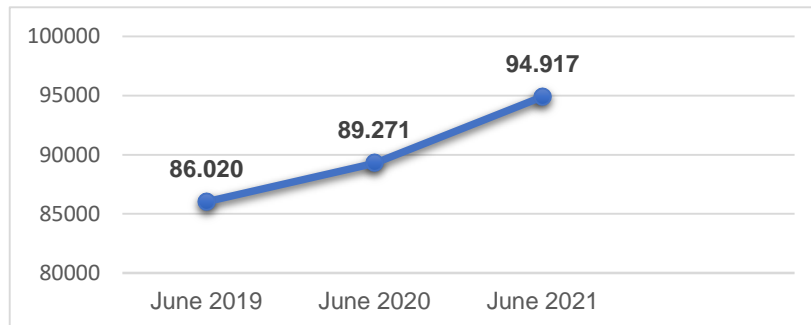


Figure 1 Number of active crafts businesses in Croatia

Source: HOK (2019-2021). *Statistical information. Data retrieved from:* <https://www.hok.hr/gospodarstvo-i-savjetovanje/statistika/obrnistvo-u-brojkama> (February 26th 2022.)

The official data that has been collected in June for the last three years, has clearly shown that there has been a constant increase of active crafts businesses in the amount of almost 9.000 new active crafts (to be exact 8.897) in the covered time period. It is obvious that the general population was not hesitant to enter the market, even though the COVID-19 crisis carried great uncertainties in the sphere of entrepreneurship.

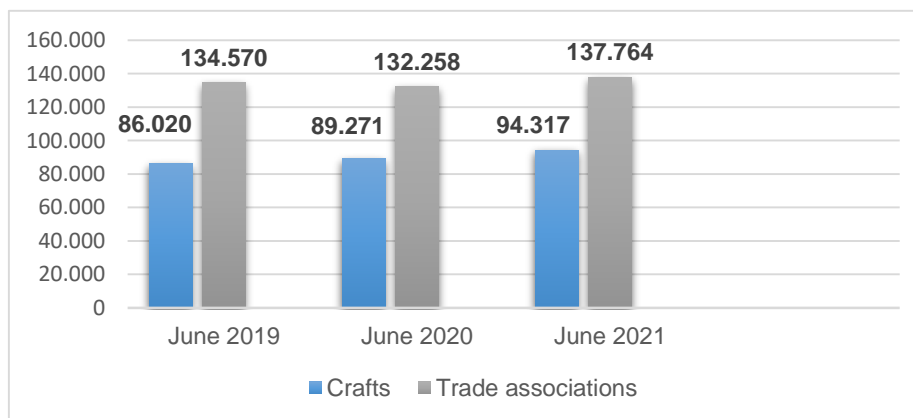


Figure 2 Number of active crafts businesses and trade association companies in Croatia

Source: HOK (2019-2021). *Statistical information. Data retrieved from:* <https://www.hok.hr/gospodarstvo-i-savjetovanje/statistika/obrnistvo-u-brojkama> (February 26th 2022.)

Active trade association companies include joint stock companies, limited liability companies, simple limited liability trade association companies, public trade association companies, subsidiaries of foreign trade companies, other legal forms. Figure 2 shows that in June 2020 there has been a slight decrease of active trade association companies. However, the year 2021 followed with an increase in

comparison with the previous year. The number of active trade associations is stable in the displayed period.

Table 1 Guild structure in crafts according to the designation of the main activity in the headquarter

Guilds	Share of active crafts June 2019	Share of active crafts June 2020	Share of active crafts June 2021
Production craft	9,1%	8,8%	8,6%
Service craftsmanship	44,1%	46,5%	49,1%
Catering and Tourism	14,3%	13,3%	12,3%
Trade	11,0%	10,3%	9,7%
Transport of persons and resources	9,4%	9,1%	8,5%
Fishing, mariculture and agriculture	4,6%	4,4%	4,1%
Hairdressers, beauticians, body care, fitness	7,5%	7,6%	7,6%
TOTAL	100%	100%	100%

Source: HOK (2019-2021). *Statistical information Data* retrieved from: <https://www.hok.hr/gospodarstvo-i-savjetovanje/statistika/obrnistvo-u-brojkama> (February 26th 2022.)

Guilds are a form of professional association at the level of regional chambers of crafts, formed in order to harmonize and resolve professional and other issues of common interest for guild members. Table 1 displays guild structure in crafts according to the designation of the main activity.

Taking into account the business seasonality in Croatia, which is in great amount depending on the sector of tourism and seasonal services, the displayed shares in the guild structure are not surprising.

3. Improvement possibilities for the crafts sector from the perspective of HOK, Ministry of Economy and Sustainable Development, HAMAG-BICRO, HBOR and Croatian Employment Service.

- **Croatian Chamber of Trades and Crafts (HOK)**

The Croatian Chamber of Trades and Crafts is an independent professional business organization, established with the aim of promoting and representing the interests of crafts. One of the crucial tasks of the Croatian Chamber of Trades and Crafts in terms of improving the status of craftsmen themselves, is to represent their interests before the Government of the Republic of Croatia, i.e. before the competent ministry, when adopting new or changing existing legislative frameworks.

The tasks of the Croatian Chamber of Trades and Crafts in the educational sense are based on providing advisory assistance in opening a new business, and assistance in case of obstacles in the business of craftsmen. It also organizes various seminars and professional gatherings for guilds and sections. HOK makes available a database of craftsmen and other companies where the apprenticeship process can be carried out, given that when choosing a craft profession, it is necessary to choose a place to perform professional practice. The Croatian Chamber of Trades and Crafts also issues permits to craftsmen and legal entities for conducting practical classes, if they meet

the specified conditions and have the equipment and workshop necessary for conducting practical classes.

The duty of the Croatian Chamber of Trades and Crafts is to organize the implementation of master's exams and exams on professional qualifications. In 2002, the former Ministry of Crafts, Small and Medium Enterprises, published the "Regulations on the procedure and manner of taking the master's exam and the professional qualification exam".

- **Ministry of Economy and Sustainable Development**

The Ministry of the Economy and Sustainable Development directly influences the development of crafts in Croatia from the aspect of preserving traditional professions, but also improving them through grants of both educational and financial nature.

There are three significant projects / programs implemented by the Ministry of Economy and Sustainable Development for the last few years. Those projects/programs are "Apprenticeship for craft occupations", "Preservation and development of traditional and artistic crafts", and "Lifelong education for crafts".

Project "Apprenticeship for craft occupations" for year 2020/2021 is intended for micro, small and medium-sized enterprises (exclusively crafts, trade companies, cooperatives and institutions) that provide apprenticeships for students who are being educated for occupations in the system of associated crafts, according to the Unified Model of Education (JMO). This call for funding was open until February 13th, 2021. The Ministry of Economy and Sustainable Development provides the grant. The total available amount of grants is 5.560.000 EUR of which: funds from the European Social Fund, Operational Program Effective Human Resources (2014-2020) 4.726.000 EUR (85%), national funds 826.666,67 EUR (15%). The lowest amount of the approved grant can be 2.000 EUR and the highest 66.666,67 EUR.

Program "Preservation and development of traditional and artistic crafts" for 2021 for micro, small and medium enterprises (exclusively crafts, trade companies and cooperatives) with the status of traditional or artistic crafts. The purpose of the funds is to finance the purchase of machinery, equipment, tools and inventory, adaptation, improvement of interiors of business and production space, implementation of quality management systems, quality standards and signs, management and protection of intellectual property, marketing activities and education and professional training of owners and employees. The Ministry under this program has approved a total budget of 466.666,67 EUR for grants. The lowest amount of grants that can be approved is 2.666,67 and the highest 6.666,67 EUR.

Program "Lifelong education for crafts" for year 2020 has been budgeted by the Ministry of Economy, Entrepreneurship and Crafts (today's Ministry of Economy and Sustainable Development). Total budget of this program is 266.666,67 EUR. Beneficiaries of grants can be micro, small and medium enterprises (exclusively crafts, trade companies and cooperatives) and natural persons. Funds can be approved in the amount of up to 80% of the amount of eligible costs for: taking the professional qualification exam, preparing for the professional qualification exam, taking the master's exam, preparing for the master's exam, retraining for occupations in the system of associated crafts, issuance of a license for performing the practical part of apprenticeship.

- **HAMAG-BICRO (Croatian Agency for SMEs, Innovation and Investments)**

Financial instruments provide support to micro, small and medium sized enterprises through loans and guarantees, with the possibility of combining with subsidized interest rates. On June 30th 2016, the Croatian Agency for SMEs, Innovation and Investments, and the Ministry of Regional Development and EU Funds, signed a Financing Agreement for the implementation of financial instruments under the Operational Program "Competitiveness and Cohesion" 2014-2020.

On April 18th 2018, the Croatian Agency for SMEs, Innovation and Investments, Ministry of Agriculture and the Agency for Payments in Agriculture, Fisheries and Rural Development signed the Financing Agreement for financial instruments implementation within the Rural Development Program of the Republic of Croatia for the period 2014-2020 (HAMAG-BICRO).

- **HBOR (Croatian Bank for Reconstruction and Development)**

The Ministry of Regional Development and EU Funds have appointed the Croatian Bank for Reconstruction and Development (HBOR) as the manager of ESIF resources, in the implementation of the financial instrument "ESIF Loans for Growth and Development". The European Structural and Investment Funds (ESIF) and commercial banks, in a 50:50 ratio, provide ESIF Loans for Growth and Development. Three commercial banks are participating in the implementation of this financial instrument: Erste & Steiermärkische Bank d.d., Privredna banka Zagreb d.d. and Zagrebačka banka d.d., which are authorized for implementation by HBOR. The commercial bank receives loan applications, and independently assesses the entrepreneur and his investment that must be in accordance with this Lending Program (HBOR, April 2020). Eligible loan beneficiaries are small and medium enterprises that have been operating for at least 2 years before applying for a loan in the territory of the Republic of Croatia, which are economically viable.

- **Croatian Employment Service (HZZ)**

The Croatian Employment Service is an institution, which is, among other things, in charge of implementing active employment policy measures. Employment support, Training support, Self-employment support, Education and training, support for Public work are the programs covered by active employment policy measures.

In the situation of negative impact of the COVID-19 pandemic on the economy, in March 2020, the Governing Board of the Croatian Employment Service decided to suspend a part of the "Program of active employment policy measures". At the same time, they introduce a new measure - "Support for the preservation of jobs in activities affected by coronavirus (COVID-19)". Which applies to employers affected by the pandemic in accommodation, food and beverage preparation, transport and storage, labor-intensive activities within the manufacturing industry - textiles, clothing, footwear, leather, wood and furniture, and employers who cannot perform activities in accordance with the decisions of the Civil Protection Headquarters.

4. Overview of available financing sources

- **Croatian Chamber of Trades and Crafts (HOK)**

In terms of financial support from the Croatian Chamber of Trades and Crafts, it provides its members with up-to-date information on EU grants, financial instruments of HAMAG-BICRO and the Croatian Bank for Reconstruction and Development

(HBOR), and financial support from the Croatian Employment Service. In terms of specific financial assistance, HOK co-finances its member's appearances at international and domestic fairs, through collective performances and joint presentation to the market.

With the "HOK Obrtnik plus" project, the chamber members are provided with more favorable conditions with suppliers of goods and services, by signing cooperation agreements. Members, for example, provided with a better price for electricity, petroleum products, gas, telecommunications services, insurance, consulting services, study programs, subscriptions to print media, IT services, and cars.

- **European Structural and Investment funds**

In the financial period from 2014. - 2020. Croatia had 10.731 billion EUR at its disposal from the European Structural and Investment (ESI) Funds.

Table 2 Distribution of allocation from ESI funds for the Republic of Croatia 2014-2020

ESI fund	Allocation (EUR)
European Regional Development Fund (ERDF)	4.321.499.588
Cohesion Fund	2.559.545.971
European Social Fund (ESF)	1.516.033.073
European Agricultural Fund for Rural Development (EAFRD)	2.026.222.500
European Maritime and Fisheries Fund (EMFF)	252.643.138
Total	10.675.944.270

Source: Data retrieved from: <https://strukturnifondovi.hr/eu-fondovi/esi-fondovi-2014-2020/> (March 3rd 2022.)

In the new financial period 2021-2027, Croatia has 25 billion EUR (in current prices) available. Available funds allocated from two source: Multiannual Financial Framework (MFF) and Next Generation EU (NGEU). 14 billion EUR allocated to Croatia for the period 2021-2027 from MFF, and 11 billion EUR is coming from the NGEU recovery instrument.

- **The role of HAMAG-BICRO and HBOR in the allocation of EU repayable funds**

Table 3 HAMAG-BICRO Financial instruments/Loans

Investment loans	Target group	Amount	Interest rate
ESIF Micro Loan	Micro and small economic operators	1.000 € to 25.000 €	0,1-0,5%
ESIF Small Loan	Micro, small, medium sized economic operators	25.000 € to 50.000 €	0,1%-0,5%
Micro Loan for Rural Development	Micro and small-sized economic operators	1.000 € to 25.000 €	0,1% and 0,25%
Small Loan for Rural Development	Micro, small, medium sized economic operators	25.000 € to 100.000 €	0,1% and 0,25%
Working Capital Loan	Target group	Amount	Interest rate
ESIF Micro Loan	Micro and small economic operators	1.000 € to 25.000 €	0,5%-1,0%

COVID-19 Loan	Micro, small and medium-sized entrepreneurs	Up to 100.000 €	0,25%
Micro Capital Loan for Rural Development	Micro and small-sized economic operators	1.000 € to 25.000 €	0,5%

Source: Data retrieved from: <https://en.hamagbicro.hr/financial-instruments/how-to-get-a-loan/> (March 3rd 2022.)

As for the “ESIF Loans for Growth and Development” by HBOR, the loan purpose is exclusively for new investments. The European Structural and Investment Funds (ESIF) and commercial banks, in a 50:50 ratio, provide these loans. Approved loan amount can be from 100.000 EUR to 3.000.000 EUR (for the tourism sector the highest amount is 10.000 EUR). The interest rate on the part of the loan from the ESI funds is 0%, and on the part of the loan from the commercial bank is in accordance with its business decision.

- **Ministry of Economy and Sustainable Development**

Table 4 Allocated funds from the Ministry of Economy and Sustainable Development 2017-2021

Project	Year 2017	Year 2018	Year 2019	Year 2020	Year 2021
Lifelong education for crafts	316.698,67	266.482,13	266.436,44	249.127,22	/
Apprenticeship for craft occupations	734.083,36	1.399.044,06	435.190,58	/	/
Preservation and development of traditional and artistic crafts	650.581,15	440.673,81	489.103,40	408.638,59	439.304,47
Scholarships for students in craft occupations	2.810.400	/	9.996.000	10.946.400	/
Development of small and medium enterprises and crafts in areas inhabited by members of national minorities	/	1.722.091,47	2.166.603,66	/	/
Development of cooperative entrepreneurship	/	333.870,62	354.716,73	256.595,67	/
Promotion of entrepreneurship and crafts	/	/	381.600	/	/
TOTAL AMOUNT OF GRANTS (EUR)	4.511.763,18	4.162.162,09	14.089.650,81	11.860.761,48	439.304,47

Source: Data retrieved from: <https://sisimg-web.gov.hr/#/> (March 3rd 2022.)

Table 4 presents programs and projects under which the Ministry of Economy and Sustainable Development has granted financial resources in the last 5 years. Part of these programs financed exclusively from the government budget, and part through EU funds. The largest increase in the allocated funds was for the program "Scholarships for students in craft occupations". This program mostly funded by the European Operational Program Effective Human Resources (2014-2020), and 15% of the funds were provided from the state budget. The project "Apprenticeship for craft occupations" financed in the same way. Given the changes in the market, there is a clear deficit of labor force in the craft sector in Croatia, which is why the logical move is to increase the promotion of education in the craft sector.

- **Croatian Employment Service (HZZ)**

According to the annual report of the Croatian Employment Service for 2020, a total of 1.027.158.089,73 EUR was spent for the implementation of the measure "Support for

the preservation of jobs" in 2020. The measures were financed by the government budget, the European Social Fund, the REACT-EU program, and by the Institute for Expertise, Professional Rehabilitation and Employment of Persons with Disabilities.

According to the report, the total expenses of active employment policy measures in 2019 amounted to 120.745.925,33 EUR, while in 2020 they amounted to 1.122.067.558,8 EUR. Out of that, the amounts of fees to the beneficiaries of the active employment policy measure in 2019 amounted to 34.684.282,67 EUR, and in 2020 to 25.734.566,67 EUR. The Program of active employment policy measures co-financed by the European Social Fund, Operational Program: Effective Human Resources.

From the crafts sector point of view, the most pronounced support of the active employment policy measures is the "Self-employment support" (17.333,33 EUR). Further, we have four groups of funds. Thus, Group 1 (up to 17.333,33 EUR) for the manufacturing sector. Group 2 (up to 13.333,33 EUR) activities of electricity, gas, steam and air conditioning supply, construction, etc. Group 3 (up to 10.000 EUR) includes wholesale and retail trade, health care, arts, transport, etc. Group 4 (up to 7.333,33 EUR) includes other service activities, administrative activities, education.

5. Craft sector in Croatia

From the aspect of possibilities for improving business support for the craft sector, experience shows that the biggest shortcomings are complicated administration, lack of institutional cooperation, and lack of economic/legal "know how". Complicated administration refers to negative experiences of craftsmen (but also small entrepreneurs in general) in situations of applying for either refundable or non-refundable grants. The wide amount of paperwork is an aggravating circumstance, in a situation where rapid access to finances is crucial. Given that the COVID-19 situation itself has led to increased digitalization, i.e. the possibility that most business processes take place online (such as online opening/registration of crafts and trades, which was not possible in Croatia until a few years ago), there is certainly more room for improvement in terms of administrative relief.

The lack of cooperation from institutions and its staff seems to be an ingrained problem in society. Political actors have discussed the issue of reducing the number of local self-government units and merging job positions in certain institutions for years. Craftsmen are expecting much greater support from the institution employees themselves, which unfortunately they are often unable to obtain (for example detailed instructions on the preparation and content of the Business Plan necessary for applying for Self-employment support). From the above it can be concluded that administrative difficulties and lack of institutional cooperation are related.

The lack of knowledge of the economic and legal spectrum is perhaps most pronounced in terms of tax models and the rights and obligations of flat-rate tax model craftsmen. Although basic business and legal knowledge is necessary for taking the master's exam, questions are being raised regarding the status of income taxpayers and the transition to the profit tax model "by force of law", as well as the obligation of craftsmen who are primarily employed by another employer.

All the above-mentioned problems represent areas in which improvement is possible and necessary, primarily through promptness, continuous education and better organization of institutions, in order to quickly and correctly solve the difficulties of

craftsmen. It is therefore important to work on the increased "input" of local self-government units, as a first instance to which craftsmen and small entrepreneurs will be able to turn, as well as increased involvement of regional chambers of crafts operating at the county level.

6. Conclusion

In recent years, there has been a marked lack of qualified craftsmen in Croatia, which is why there is a public emphasis on the need for education and training in the craft sector, even more than for higher education. The need for skilled craftsmen and small entrepreneurs became even more pronounced due to the tragedy and devastating consequences of the two earthquakes that occurred in 2020. Therefore, statistical information on the increased number of open and active trades, increased grants for scholarships and education in craft occupations, are in line with the sequence of events and changes in the Croatian economy.

From the aspect of financial support to crafts and small business as a whole, through the presented sources of financing and the presented amounts of approved financial support, it is not difficult to conclude that Croatia's EU membership is crucial in terms of exercising the right to refundable and non-refundable financial support. Although a significant amount of funds from the state budget has been allocated for various programs and projects mentioned in this paper, the volume of funding from the EU budget is much more extensive. In a crisis (such as the pandemic), European Union support is even greater with the use of new recovery instruments such as the "Next Generation EU". In accordance with the above, it can be concluded that more than a sufficient "budget" of the European Union is available to crafts, small and medium enterprises, and it is allocated through various institutions of the Republic of Croatia. Only the ability of the entrepreneur to apply for and achieve the right to the funds that are available is questionable. It comes to the issue of cooperation, and the possibility of improving the cooperation of craftsmen (entrepreneurs) with various institutions and units of regional and local self-government, which are obliged to provide informational and professional support to craftsmen, in order to maximize the ability of the crafts sector to receive financial support. It is necessary to break the perception of inability of small businesses to achieve the right to available subsidies, due to the potentially negative entrepreneurial climate, given that various programs and instruments of the European Union provide opportunities that were previously unavailable for the Croatian small business sector.

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CORRUPTION IN FUNCTION OF STATE EFFICIENCY

Damir Piplica

University Department of Forensic Sciences, Split, Croatia
damir.piplica@unist.hr

Tihomir Luković

University College Aspira, Split, Croatia
tiholukovic@gmail.com

Vjeko Luetić

University Department of Forensic Sciences, Split, Croatia
vlueti82@gmail.com

Abstract. The functioning of a state is a complex process that primarily depends on the macroeconomic national system. During the functioning of the state, obstacles such as corruption arise in the system, reducing the effectiveness of the state. Therefore, the purpose of this research is to analyse the effects of corruption on the effectiveness of a state, observed through the results of measurable state activity. The aim of this research is to assess the direction, form and intensity of corruption effects on indicators of state activity. In order to assess the direction, intensity and form of the impact of corruption on indicators, correlation will be used for each of the segments/indicators of state activity. Furthermore, in order to get the final result and explanations of the relationship between corruption and state activity indicators, a comparison of one developed EU country - Germany - with a country in transition - Croatia - will be made. Given the research methodology, in addition to the classical methods of analysis and synthesis, the desk research method will be used, along with correlation coefficients. In order to get the final result and explain the connection between corruption and indicators of state activity, the method of comparison will be used to reach a final conclusion. Using this methodology, the conclusion will demonstrate the role of corruption in the state activity system. Also, the research is expected to show which segments of state activity are affected more by corruption and which are affected less or unaffected, and what is the effect of the impact of corruption on the success of state activity. In particular, it is expected that this research will identify the impact of corruption on the indicators of state activity in the field of entrepreneurship, which is the backbone of a national economy. It is difficult to predict the results before calculating the correlation, but the research hypothesis can be related, with great certainty, to the more visible impact of corruption on those segments of the state activity in which a part of the state budget is located.

Key words: *macro systems, corruption, developed countries, countries in transition, the functioning of the state*

1. Introduction

The functioning of a state depends on many factors, primarily on the macro national system, its subsystem that ensures the course of realization of macro goals, but also on the subsystem of supervision. At the same time, corruption appears as a human action which is intended, in organized societies, for achieving something that cannot be legally achieved to gain a certain advantage over others or some benefit. In countries in transition, when it comes to the European Union countries, corruption occurs for a number of reasons, and primarily due to the dysfunction of the state. What

is particularly interesting is the existence of corruption known as „legal corruption“. Legal corruption is allowed or has been allowed until recently in many developed countries of the EU and the world, and has developed as a form of benefiting from economies in transition which are rich in resources or other values, but also from other countries whose goods or special knowledge can be obtained from corruption.

Thus, the connection between corruption and functioning of the state is logical, but it has not yet been measured. The notion of the functioning or non-functioning of the state is not monitored at the national level, but it is still monitored to some extent at the level of mega systems, such as the European Union or large international organizations. At the same time, corruption is monitored, analysed and ranked by country, but the correlation between corruption and the functioning of the state is not calculated, so this is left to scientists and research to which this paper belongs.

The purpose of this research is to analyse the relationship between corruption and functioning of the state in order to conclude the intensity and direction of the correlation between these two phenomena. The research goal is contained in the valorisation of the degree, strength and form of the connection between corruption and the functioning of the state. Consistent with the goal of the research, it is implied in the research hypothesis that corruption significantly affects the functioning of the state. The comparison method is utilised to compare the indicators of Croatia and Germany in order to reach the conclusion on impact and the role of the macro-national system on the efficiency of the functioning of EU countries.

2 Brief overview of research on the economic consequences of corruption

The general view is that corruption is a great evil in every society. Many scientists deal with corruption, research it and conclude on the economic consequences of corruption. Baumol (1990) once studied a special form of corruption called „rent-seeking“ and chronologically argued its negative impact on economic growth. Barro (1991), as well as Brumm (1999) came to the same conclusions. On the other hand, Murphy, Vishny, and Schleifer (1993) studied the situation on the structure of various types of employee incomes in production in the United States, as well as those who are involved in certain forms of „rent-seeking“. The authors came to the conclusion that „rent-seeking“ negatively affects economic growth. He questions what the term „rent-seeking“ means. „Rent-seeking“ is an effort to increase one's share in the existing wealth, but without creating new wealth. In the national economy, „rent-seeking“ occurs in various ways. In essence, „rent-seeking“ reduces economic efficiency through the misallocation of resources, thus reducing the wealth creation of the economy for which it is conducted. At the same time, the state loses its expected revenues with increasing income inequality. In this way, the reduction of the growth of the national economy is directly affected. „Rent-seeking“ can occur as pressure from states or large international corporations, due to the takeover of resources and the acquisition of wealth, and is achieved through regulatory agencies. In essence, it is a matter of capturing regulatory agencies in order to forcibly acquire a monopoly on the market. Through „rent-seeking“, the advantages of those who seek extra profit on the market can be achieved by imposing fictitious macro shortcomings on uncorrupted competitors. Thus, „rent-seeking“ is a special form of corruption that favours one subject over another.

The harmful effects of corruption on economic growth have been confirmed by numerous corruption researchers. For example, Shleifer and Vishny (1993) conducted research in Russia, the Philippines and Africa, and stated that corruption is a cost to society. The role of cost is interesting, so it will be explained below. The negative impact of corruption on economic growth has been confirmed by Sachs and Warner (1997), Mauro (1996), Brunetti (1997), Ehrlich and Lui (1999), Kaufmann, Kraay and Zoido-Lobaton (1999), Leite and Weidmann (2002), as well as Gyimah-Brempong (2002), Neeman, Paserman and Simhon (2004) and Welsch (2004), Pellegrini i Gerlagh (2004). In his research, Mauro (1995) highlighted the negative impact of corruption on investment. Lui (1996) has a similar opinion, but with the remark that the negative impact of corruption relates to the long-term growth rate. Rahman, Kisunko, and Kapoor (1999) found that the reason for the negative impact of corruption on economic growth is the reduction in foreign direct investment (FDI). Mo, Méon i Sekkat (2005) conclude that the inefficiency of the central state administration is the main reason for the negative impact of corruption on economic growth. Aidt, Dutta i Sena (2008) state something similar that is, they conclude that the level of institutional quality is the main reason for the negative effect of corruption on economic growth. Their research shows that in countries with a high quality macro-national system, corruption has no impact on economic growth.

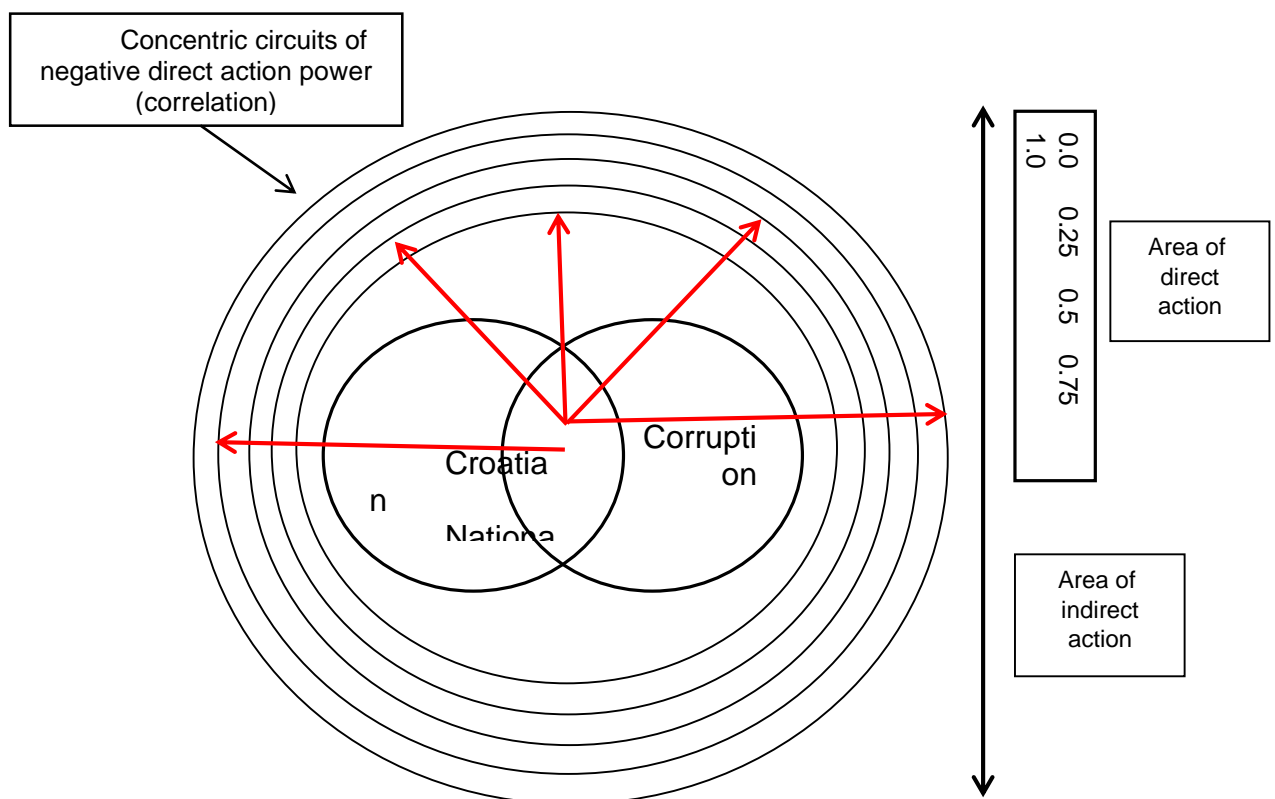


Figure 1 Model of coexistence of a bad system and corruption
 Source: modelled by the authors

As can be seen from the graph within the national circle, the effects of corruption are direct but also indirect and destroy many aspects of the state and society.

However, it is especially important to distinguish corruption within the state circle from corruption that occurs between states. That is, corruption that takes place between states takes place between corrupt high-ranking politicians of one state and representatives of another state or a large company. Such corruption is called „legal corruption“ and is corruption that takes place due to the acquisition of resources or some other economic values. Such corruption generally takes place between countries in transition and more developed countries, and is also present between EU countries and is very difficult to prosecute. It is present in states organized as kleptocracies, oligarchies, drug states and mafia states (Worldbank report 2015). However, harsh condemnation and labelling of „legal corruption“, as stated by the World Bank, is justified on the one hand, but on the other hand it is also taking place among EU countries. For example, research by Kaufmann and Vicente (2005) described what was going on with legal corruption in Germany in the 1990s. That is, the German Financial Commission in 1994 in Bonn presented a study on legalized corruption in the industrialized OECD countries (Bonn Parliament records, 1994). Such a form of corruption has met with conflicting opinions in parliament, but under the influence of the American Foreign Corrupt Practices Act (FCPA of 1977) corruption perpetrated by large companies and the state, in 1999, after the entry into force of the OECD Convention on bribery, Germany withdrew the decision to legalize such a form of corruption („Drucksache 12/8468“). Given that the phenomenon of „legal corruption“ is associated with developed countries in the EU and the world, the same research explains it for many countries such as Denmark, France, Luxembourg, the Netherlands, Austria, Switzerland, UK, Japan, USA and Canada.

Among Croatian authors, Piplica researched the economic consequences of corruption. Given the different consequences of corruption on an economy, the author clearly distinguishes between „good“ and „bad“ corruption. „Many countries in East and Southeast Asia, such as China, South Korea, Japan, Taiwan, Thailand and Indonesia, have achieved great economic growth and development, although corruption is quite widespread in these countries, so it is the so-called „East Asian paradox“. If a civil servant, who enabled the rapid and efficient realization of an investment that resulted in the creation of new social value, new jobs and new employment, a new competitive product, etc., is bribed, then such corruption, despite its social disapproval, has a certain positive effect on an economy. On the other hand, we can cite an example where some forms of corruption would result in the destruction of companies, jobs, etc., which is much more common and which would characterize it as an entirely negative corruption activity (Piplica, 2020, p. 89). Piplica et al. (2021) found a negative impact of corruption in Croatia on the emigration of Croatian citizens. Piplica (2021a) suggests implementing the economic consequences of corruption in criminal legislation, which would have a positive effect on sanctioning forms of corruption that are most harmful to the Croatian economy. Furthermore, Piplica (2011) found a weaker positive impact of corruption on inflation in transition EU Member States. The author concluded that the impact of corruption on inflation is largely indirect and occurs with a time delay because it takes a certain period of time to shift the „cost of corruption“ to the ultimate bearers of such costs.

The fact remains that in 2021, out of 180 countries in the world, Croatia was in 63rd place, and in 2012, out of 176 countries, Croatia was in 62nd place (Transparency International). Considering the ranking of corruption in the EU, in 2013 Croatia was on the 22nd place out of 28 countries, and in 2020 on the 24th place out of 27 EU countries, which means that Croatia fell by 2 places (Transparency International). At the same time, in terms of entrepreneurship, in 2021 Croatia, together with Bulgaria, ranks last in the EU (GEM). The question arises, what is the role of the macro-national system of Croatia in maintaining corruption and inefficient functioning of the state.

3 Macro national system and state efficiency

When researching a macro system, in young systems theory, there are not too many scientific papers. The effectiveness of each country's macro system requires a multidisciplinary approach. Therefore, consideration on systems is increasingly applied in various fields of research, from education, defence, managerial decision-making to the analysis of personal interpersonal relationships. Following this thinking about macro systems, Moh states: „The modern philosophy flow reveals that systemic thinking is a holistic approach to research. Proponents of this school call systemic thinking „a new paradigm of modern thought“ (Moh, 2020, p. 1). In support of the scientific approach to system analysis speaks English who researched the education system (English, 2007). English claims that the analysis of the system will enter the philosophical school, more precisely in a part of that school known as scientific realism. In thinking and researching macro systems, Bronfenbrenner (2002) stood out, explaining the impact of the social environment on human development. In his research and work, Bronfenbrenner points out that each macro system consists of numerous variables immanent to a particular society, that is, the state. Starting from the explanation of the effectiveness of a macro system, Bronfenbrenner defines it as: „*Macro system refers to the consistency observed in a given culture or subculture in the form and content of its constituent micro-, meso- and exo-systems, as well as any belief system or ideology which are the basis of such consistency*“. He points out that the macro system consists of six super systems: globalization, government, economy, family, religion and media (Bronfenbrenner, 1989).

According to scientific research, a macro system could be defined as “*an interconnected set of business processes (or components) used within a single business unit that work together for a purpose. The boundary separates the system from the environment. The system receives the input from the outside, processes it and sends the resulting output back to its environment*“.¹⁰ According to the above definition, it is clear that the macro national system must be an organized set of interconnected units and subsystems on which it is based. A macro system, in order to be effective, must be long-term, stable and independent of party affiliation, thus ensuring its stability. It sets the criteria for society and the functioning of the state, which means that in the absence of it, there are a number of factors that strongly influence the inefficiency of the state administration. Therefore, it is the obligation of

¹⁰ PadaKuu.com was designed as a system of scientific and highly educated information „*System definition and concepts / characteristics and types of system*“ www.padakuu.com/article/2-system-definition-and-concepts-characteristics-and-types-of-system

each state to build its own macro system with regard to the external and internal environment.

Factors of contemporary macro systems that are indispensable in their formation are: heritage in a broader sense, socio-political determinant of the state and people (civil society in some of its forms), religion, long-term macro goals of the state and people, achieved development in a broader sense, and other. In this regard, each state shapes its national macro model from which it then develops supporting super-systems that become pillars of one whole and make up the national macro system. The fact is that the national macro system is transformed into the life of the citizens of a certain state and together with the people becomes a living system of the state. The lack of a macro system with these characteristics is becomes a problem for the functioning of the state, and there are forms of state action based on negativity and crime. One of the current and devastating factors of illegal action and problem solving, which significantly reduces the efficiency of the state, is corruption. The question of the efficiency of the functioning of a state and state administration in the conditions of a quasi-system and a stable organized macro-national system is raised.

4 Corruption and efficiency of macro systems in Croatia and Germany

As can be seen from Figure 1, through direct and indirect action, corruption affects the system, infiltrates it and takes over its functionality to a greater degree. Through the combination of quasi-macro systems and corruption, concentric circles spread the negativity and bad influence of corruption that occurs in all subsystems and social phenomena, but with different intensity. Corruption impacts some subsystems directly, and others indirectly, with varying intensity and damage. Since all damages can be assessed, both in the intensity of action and in financial terms, it is a research challenge to present the methodology and results of this relationship.

Table 1 Efficiency of macro national systems of Croatia and Germany

Years	Indicators	Croatia	Croatia	CPI Croatia	Germany	Germany	CPI Germany
2019	1	4.15	35/54	47	5.31	11/54	80
2019	2	3.04	48/54	47	4.07	29/54	80
2019	3	2.46	50/54	47	4.15	26/54	80
2019	4	3.41	45/54	47	6.21	1/54	80
2019	5	2.0	50/54	47	2.71	36/54	80
2019	6	3.28	52/54	47	4.8	25/54	80
2019	7	2.61	52/54	47	4.78	11/54	80
2018	1	3.97	35/54	48	4.75	22/54	80
2018	2	2.82	49/54	48	4.28	27/54	80
2018	3	2.1	53/54	48	4.34	19/54	80
2018	4	3.29	47/54	48	5.81	4/54	80
2018	5	2.45	42/54	48	3.03	26/54	80
2018	6	3.71	52/54	48	4.55	35/54	80
2018	7	2.97	47/54	48	4.57	13/54	80
2017	1	4.02	35/54	49	4.72	18/54	81

2017	2	3.26	46/54	49	4.39	22/54	81
2017	3	2.14	52/54	49	4.08	24/54	81
2017	4	3.6	40/54	49	5.63	5/54	81
2017	5	2.39	46/54	49	2.56	42/54	81
2017	6	3.69	51/54	49	4.24	43/54	81
2017	7	3.29	43/54	49	4.33	17/54	81
2016	1	3.79	48/65	49	4.95	10/65	81
2016	2	2.8	65/65	49	3.93	39/65	81
2016	3	2.18	65/65	49	4.12	28/65	81
2016	4	3.46	51/65	49	5.74	3/65	81
2016	5	2.47	52/65	49	2.75	46/65	81
2016	6	3.83	56/65	49	4.25	47/65	81
2016	7	2.73	62/65	49	4.14	22/65	81
2015	1	3.3	53/62	51	4.3	23/62	81
2015	2	2.84	59/62	51	4.25	26/62	81
2015	3	1.99	61/62	51	3.85	31/62	81
2015	4	3.0	59/62	51	6.0	6/62	81
2015	5	1.89	57/62	51	2.68	40/62	81
2015	6	3.53	58/62	51	4.13	49/62	81
2015	7	2.85	59/62	51	4.01	26/62	81

1 - Access to entrepreneurial finance, 2 - Government policy: support and relevance, 3 - Government policy: taxes and bureaucracy, 4 - Government entrepreneurship programs, 5 - Entrepreneurial education at school, 6 - Entrepreneurial education post school, 7 - Research and development transfer, EFCs scale: 0 = very inadequate insufficient status, 10 = very adequate sufficient status.
Source: GEM, Transparency International

Table 1 very clearly shows the difference in the efficiency of individual segments of the national macroeconomic systems of Germany and Croatia. In almost all measurements, Croatia is among the worst rated in terms of efficiency in all observed countries. The efficiency of the German in relation to the Croatian macroeconomic system is at a much higher level, but it also shows problems in certain segments. It is clear that, for example, Entrepreneurial education post school in Germany is not as well rated as Entrepreneurial education at school. On the other hand, Government entrepreneurship programs in Germany are very effective and among the best in the observed countries. The comparison of the values of individual indicators is best shown by Graph 1, from which we can see that the efficiency of Croatia in relation to the German macroeconomic system is at a much lower level.

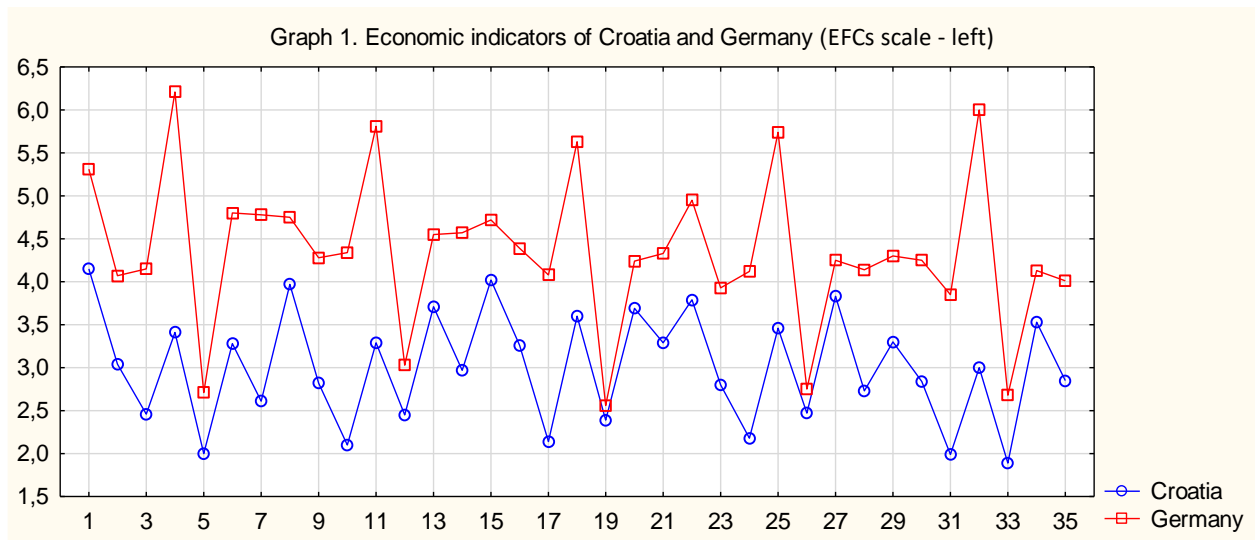


Figure 2 Economic indicators of Croatia and Germany (EFCs scale - left)

Source: modelled by the authors

Measurements of the perception of corruption in Croatia and Germany also show very different values, which indicates that Germany is a country with a significantly lower level of corruption compared to Croatia (Table 1). Thus, in the observed period, Croatia had the lowest level of corruption measured by the CPI index of 47, and the best level of only 51. In contrast, the lowest level of CPI for Germany was a high 80 points, and the best 81, which indicates very stable and high levels. Given that corruption has its economic face, let's look at how it relates to existing macroeconomic indicators of the effectiveness of the German and Croatian systems.

Table 2 Regression Results Croatia and Germany

Dependent: indicators	R = 0,64977653	F = 49,68972
	R ² = 0,42220954	df = 1,68
No. of cases: 70	adjusted R ² = 0,41371262	p = 0,0000001
Standard error of estimate: 0,790928937		
Intercept: 0,975440965	Std. Error: 0,3953854	t(27) = 2,4671 p = 0,0161
CPI b* = 0,650		

Source: Author's calculation

The results of the regression analysis for 70 cases of macroeconomic efficiency indicators of the Croatian and German systems clearly show a high degree of correlation (correlation coefficient 0.65) with the level of corruption in the two observed countries. Namely, the lower the amount of corruption (higher CPI), the better the indicators of the macroeconomic system when we look at Croatia and Germany together. This is also very evident from Graph 2 which shows the upward and positive direction of movement.

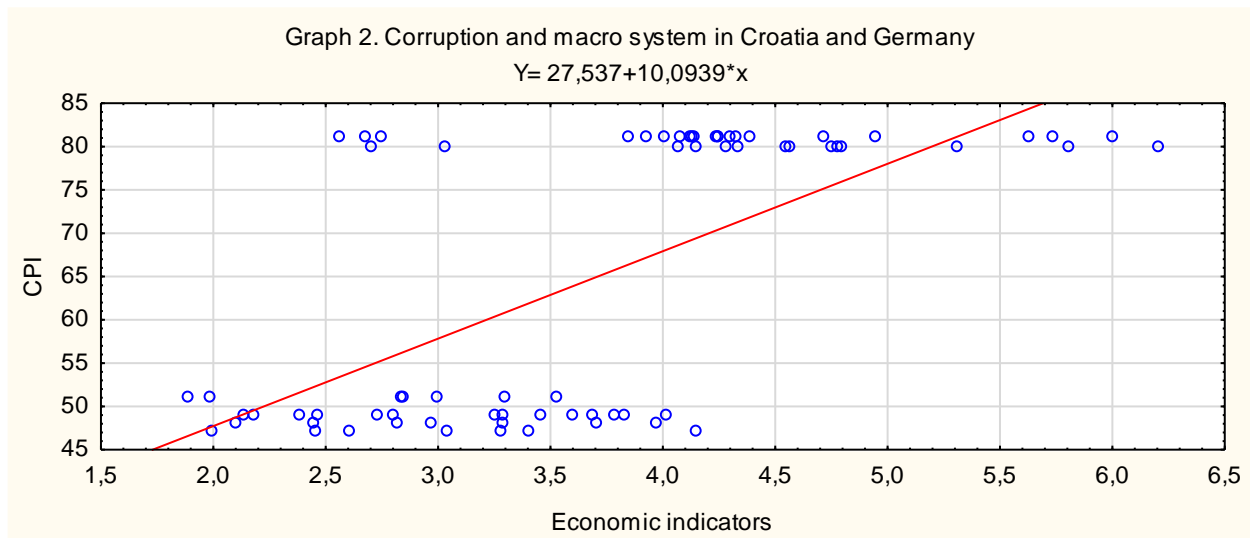


Figure 3 Corruption and macro systems in Croatia and Germany
Source: modelled by the authors

The groupings of indicators, as can be seen from the graph, confirm the higher degree of stability of the German macroeconomic system as well as its significantly higher efficiency. In contrast, Croatia shows an unstable macroeconomic system as well as low efficiency observed in terms of its efficiency indicators.

5 Conclusion

The foundation of every national economy is entrepreneurship, and especially the category of small and medium enterprises (SMEs) in it. Each country with its macro-national system and policy of cooperation and attitude towards entrepreneurship dominantly shapes the result of the development of national entrepreneurship and economy. Many problems stand in the way of development, and one of the key problems of today is corruption. In the young mega system of national economies of the European Union, corruption is increasingly being researched and analysed, and tools and systems are being developed to minimize it, led by developed EU countries. Given its size and economic strength, the German macroeconomic system is a model for many countries, so many studies focus on comparisons with that country. At the same time, it is obvious that a stable and high-quality macroeconomic system is a basic factor for all actions that result in positive results for the community.

The analysis and comparison of the Croatian and German macrosystems, observed through transparent efficiency indicators, shows that the Croatian macro-national system is still unstable. The attitude of the state administration towards entrepreneurship is poorly designed and not proactive. The analysis of the connection between corruption and the macrosystem of Croatia, observed according to the indicators of its macrosystem, shows a high degree of correlation. All this points to the need for stronger implementation of science in the system of political decision-making at the highest level as well as the development of a corruption prevention system modelled by the German system in all its state administration services. There is no doubt that better results are possible, but political will and the implementation of scientific research results are needed. Croatia is still exposed to a higher level of corruption, which requires a quick and systematic approach to its prevention, which

would achieve a higher quality of the Croatian macro-national system. This process requires time and appropriate knowledge which is insufficient in application because systems science is still a young science.

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WAYS TO ATTRACT CUSTOMERS TO EMD TENNIS ACADEMY BACAU / COURTYARD BY MARRIOTT HYANNIS

Daniel Gherasim

George Bacovia University, Bacau, Romania

Daniel.gherasim@ugb.ro

Adrian Gherasim

George Bacovia University, Bacau, Romania

adrian.gherasim@ugb.ro

Abstract. The main objective of this research is to find out what, in the view of employers, are the strategies to improve customer relations in the provision of tourism services.

The secondary objective is the ways in which hoteliers want to attract as many customers as possible.

The research hypotheses are:

1. Hotel managers consider that the improvement of customer relations appears as a result of the adequate training of the staff in the front desk department, they having the greatest influence in creating a customer relationship.
2. There are differences between the strategies of improving the customer relations of the two analyzed hotels.

Attracting customers is a topic that moves all hotel staff, this being the first step towards motivation and satisfied customers. Both the EMD Tennis Academy Bacau hotel complex and the Courtyard by Marriott Hyannis hotel place a lot of emphasis on the official website, which is the image with which they represent themselves in front of customers. The sites are attractive, with a nice design, easy to navigate, with clear and concrete information about each type of service offered by the hotel, their description, contact details, accessibility and ways to get to the hotel.

Key words: *Customers, qualitative research, hospitality industry, customer needs, questionnaire*

1. Introduction

Excellent services are one of the main goals of the hospitality industry. Hotel guests are based on the hospitality of the staff in relation to their travel needs. When a customer is in trouble, the kindness of the staff is what is emphasized in providing the necessary information and solutions to unforeseen situations that arise during the trip. In most cases, customer satisfaction is measured by hoteliers through questionnaires made available to guests in hotel rooms. Their role is to find out if the guests were satisfied with the services they chose and what they liked, otherwise hoteliers ask for suggestions on what they should change to please their current customers and how they could improve the service for potential customers. This method is the basis of the main objective of hoteliers, being encouraged more and more often lately.

Attracting customers is a topic that moves the entire hotel staff, this being the first step towards satisfied and satisfied customers. Both the EMD Tennis Academy Bacău hotel complex and the Courtyard by Marriott Hyannis hotel place a lot of emphasis on the

official website, which is the image with which they represent themselves in front of customers. The sites are attractive, with a nice design, easy to navigate, with clear and concrete information about each type of service offered by the hotel, their description, contact details, accessibility and ways to get to the hotel.

Another method of attracting customers used by both hotels is the signing of collaboration contracts with various travel sites, offering customers the opportunity to find them more easily on booking sites. The most requested and most profitable ways to promote and attract customers nowadays are on social networks, especially Facebook, which allows hotels to create an official page where all kinds of attractive offers for customers can be posted, being a means faster to interact with them than in agencies or on booking pages.

Unlike EMD, the Courtyard by Marriott Hotel also has an Android and IOS app, where customers can easily and quickly book a room without having to use a laptop or contact intermediate booking sites. The Marriott App is a simplified version of the Marriott Web Page that can be accessed much more easily and efficiently.

The most attractive way to attract customers to the Courtyard by Marriott Hyannis is the Marriott Rewards Program, a program that gives customers brand confidence and the ability to earn bonus points when purchasing any service in the Marriott chain then used in the form of vouchers or discount coupons. They also use Elite Member status for loyal customers which in turn have a number of benefits. A more specific aspect of the services in Romania is the use of flyers, leaflets and brochures among tourists, which can be seen in the EMD Tennis Academy Bacău, but is less found in the United States, they are more focused on technological development and its usefulness.

2. Unit objectives regarding customers

The objectives of the EMD Tennis Academy Bacău hotel complex and of the Courtyard by Marriot Hyannis hotel focus on the same customer segment and aim to satisfy their needs and desires.

Another goal of the two hotels is to provide a fair value for money. This is possible by providing high quality services, thus exceeding customer expectations. The expectations of the clients vary constantly, each having different needs and desires, the hoteliers being forced to be in a continuous process of adaptation. However, hotel guests will always look for quiet, clean and comfortable rooms with sanitary and modern bathrooms, which is the basis for a very good value for money.

2.1 Strategy applied in relation to customers

The academic literature describes three types of strategies for improving customer contact. These are: strategies to reduce personal contacts, a strategy that emphasizes the development of ways to communicate by phone, fax, e-mail or mail, leaving the contact face to face for exceptional situations, also on the use of the reservation or scheduling system of customer meetings and the use of the answering machine.

The second type of strategy is the strategy of improving the ways of conducting contact, this being composed of ways such as designating for contact those people who have behavioural skills, systematic observance of working hours scheduled for contact with customers and rational sharing between activities back office and front office activities.

The last category of strategies are strategies to stimulate weak contacts by establishing control points for inputs and outputs from each department, standardizing parts of the service process, standardizing individual times and establishing spending centres (R.M. Stock and Wayne D. Hoyer, "An attitude-behavior model of salespeople's customer orientation," Journal of the Academy of Marketing Science, vol. 33, no.4, 2005).

Thus, it can be seen that the strategy applied in relation to customers both in the EMD Tennis Academy Bacău hotel complex and in the Courtyard by Marriott Hyannis hotel is based on the designation of people who have very well developed behavioural and communication skills to create a positive image in front of customers.

The staffs in the front desk department are the one who has the most influence in the relationship with customers. For this activity, they choose people with communication skills and interaction with very high customers, people with a positive and detached spirit, people who are relaxed and eager to offer the best services to hotel guests. So they encourage their employees to interact with the guests in the most pleasant and friendly way possible. It is advisable for them to create favourable relationships with hotel guests and relationships based on trust and professionalism to help them in the future. Clients with positive experiences will always return with pleasure and will always spread the benefits offered by the hotel in which they were accommodated, thus creating the opportunity for new customers for hotels.

In order for the services to reach the highest level of customer satisfaction, the staff of the front desk department benefit from regular training courses, through specialized trainings and workshops, in order to prevent any situation in the interaction with customers. They are put in fictitious situations to find the most effective solutions to problems, each being placed both in the situation of being a customer and in the situation of being a receptionist. It is very important that they act quickly and efficiently, with kindness and professionalism, without getting emotionally involved in unforeseen situations noticed by customers during their stay in the hotel (Turcu D., Weisz Janeta, Economics of Tourism, Eurostampa Publishing House, Timișoara, 2008, 231-233).

2.2. Research objective and hypothesis

The main objective of this research is to find out what, in the view of employers, are the strategies to improve customer relations in the provision of tourism services.

The secondary objective is the ways in which hoteliers want to attract as many customers as possible.

The research hypotheses are (Bedrule-Grigoruță M., Service Management, Tehnopress Publishing House, Iași, 2013):

1. Hotel managers consider that the improvement of customer relations appears as a result of the adequate training of the staff in the front desk department, they having the greatest influence in creating a customer relationship.
2. There are differences between the strategies of improving the customer relations of the two analysed hotels.

3. Research method and tool

Qualitative research is performed to find out the desired information directly from the respondents, the chosen method being the interview, more specifically the in-depth interview.

The in-depth interview is a free conversation between two people, in which the researcher asks a series of questions to the interviewed individual based on a research topic, with the help of a pre-conducted interview guide (Boier, R, Consumer Behavior, Graphix Publishing House, Iași, 1994).

Interviews usually involve a transfer of information from the interviewee to the interviewer, which is the main purpose of the research. The interviews usually take place face to face, which also took place during the interview with the manager of the EMD Tennis Academy Bacău hotel complex, but thanks to the technology they can also take place by phone or via the Internet, video conferencing or offline, via e-mail.

In-depth interviews can range from unstructured conversations, in which the research topic is presented, followed by a free discussion, with questions asked along the way, without a pre-established plan, to semi-structured conversations where there is an interview guide, but they are addressed and questions according to the answers received, and finally to very well-structured conversations based on an interview guide, but this is fully respected, without deviating from the predetermined order of the questions (Manfred Bruhn, Customer Orientation - The Foundation of Successful Business, Economic Publishing House, Bucharest, 2001) .

The advantages of an in-depth interview are that the open-ended questions offer the interviewee the opportunity to conceive detailed, free, subjective answers, the subject of the research being able to be treated in a more complex way.

The disadvantage of using this research tool would be that it is more difficult to analyse and interpret the answers received, as they do not have closed answers. It is also possible that the answers received may go in certain undesirable directions if the researcher is not prepared to divert the discussion to what he or she wants to know (Radu E., Service Management, Dimitrie Cantemir Christian University, 1994).

The interview guide is a set of structured questions that help a researcher to find the desired information from the interviewed subject. It is a useful method for people who want to touch as many topics as possible in an interview in which the questions are open, and the respondent has the opportunity to provide answers in his favour. In our case, the interview guide had a set of 9 questions.

The advantages of an interview guide are a number of helpful aspects because it can induce certain answers to the interviewee in an indirect way and more confidential information can be found in a general way.

As for the disadvantages, they relate to a lower level of information, as it is not possible to reach too many topics.

Next I will present the transcript of the interview with the manager of the EMD Tennis Academy Bacău hotel complex.

3.1. Interview guide

1. *What is your status in the EMD Tennis Academy Bacău hotel complex?*

I'm the hotel manager. In general, I coordinate all the activity within the hotel, I respond to the clients to the e-mails sent for informational or feedback purposes. I also manage difficult situations, respond to complaints or unforeseen situations, and try to provide customers with the solutions they want.

2. *Introduce in a few words what services the EMD Tennis Academy hotel complex offers to its customers.*

Our hotel complex offers accommodation services with a number of 14 double, twin rooms, studios and apartments, food services where we provide breakfast, lunch or dinner and leisure services. For leisure we have free access for customers to the pool, sauna, table tennis, squash and Jacuzzi, but we also offer individual tickets or subscriptions to any leisure service you want.

3. *What is the mission of the EMD Tennis Academy Bacău hotel complex?*

The mission of the EMD hotel complex is to provide high quality services to our customers, to get closer to them and to anticipate and satisfy their needs.

4. *Describe in a few words what ways to attract customers use the hotel complex EMD Tennis Academy Bacău.*

The ways to attract customers that we use are booking sites with many contracts with various travel sites, promotional flyers or with the rates charged, price reductions depending on the number of people or the number of nights purchased, promotions, subscriptions within the leisure area.

5. *What are the objectives of the EMD Tennis Academy Bacău hotel complex regarding the clients?*

The objectives of the hotel complex are to attract as many customers as possible through the low price strategy and to serve customers with kindness and respect, attracting as many customers as possible both locally and regionally.

6. *What is the strategy applied in relation to customers?*

The strategy applied in the relationship with customers is to improve the ways of conducting contact by designating for contact those people who have behavioural skills to provide the best services to customers, to meet their needs and desires, exceeding their expectations. Specifically, there is a careful selection of reception staff, taking into account the communication skills of employees or future employees.

7. *How does the EMD Tennis Academy Bacău hotel complex intend to retain potential customers?*

We aim to build customer loyalty through price reductions, travel packages and promotions depending on the season.

8. *Is it true that front desk staff has a certain influence on customer relations? If so, can you explain in what way?*

Yes, the staffs in the front desk department is the one who gives the first impression to the customers, that's why we do our best to offer them the best training resources.

9. *What improvement strategies do you think the EMD Tennis Academy Bacău hotel complex should apply in its relations with its clients?*

I believe that we should constantly adapt to the needs and requirements of our customers in order to exceed their expectations when choosing our hotel complex through various customer loyalty strategies.

In the future we want to implement the strategy of customer loyalty through co-branding. Being associated with the karting track in Bacău, we offer them free access to the karting track for leisure during our entire stay in our hotel.

4. Analysis and interpretation of results

Based on the above, we chose the qualitative interview as a research method; the tool used being the *in-depth face-to-face interview*. To make it easier for us, we chose the

structured interview technique, constituting an interview guide consisting of nine open-ended questions.

Following the interview, we managed to collect the data necessary for our research, and below we will analyse them and interpret the results received.

Interpretation of results

Question no. 1: What is your status in the EMD Tennis Academy Bacău hotel complex / Courtyard by Marriott hotel?

Interpretation: *At the EMD Tennis Academy Bacău hotel complex, Cristina Pintilie is the administrator of the complex being responsible for the entire activity of the complex and has held this position since 2010, while at the Courtyard by Marriott Hyannis hotel, Mrs. Wendy Anderlot is the general manager of the hotel, which provides activity reports to the hotel owner.*

Question no. 2: Explain in a few words what services the EMD Tennis Academy / Courtyard by Marriott hotel offers to its guests.

Interpretation: *According to this question, we found out that both hotels have the three main types of services, namely accommodation, food service and leisure service. Unlike the Courtyard by Marriott Hyannis hotel, which has only breakfast and dinner services and an indoor pool and fitness room, accessible only to hotel guests, the EMD Tennis Academy Bacău hotel complex offers guests all three types of menus, breakfast, lunch or dinner, followed by unconditional access by the accommodation service for the leisure area where you can choose between: swimming pool, sauna, fitness room, table tennis or squash. At the same time, the EMD Hotel offers the possibility to purchase season tickets for any leisure activity.*

Question no. 3: What is the mission of the EMD Tennis Academy Bacău hotel complex / Courtyard by Marriott Hyannis hotel?

Interpretation: *The missions of the two hotels are carried out for the same market segment, the desire to provide exceptional services to customers traveling in their vicinity being the primary objective. They want to exceed customer expectations by meeting their needs with the help of high quality services.*

Question no. 4: Describe in a few words what ways to attract customers using the EMD Tennis Academy Bacău hotel complex / Courtyard by Marriott Hyannis hotel.

Interpretation: *Both EMD Tennis Academy Bacău and Courtyard by Marriott Hyannis use the same methods of attracting customers as price reductions or seasonal promotions. The promotion methods and distribution channels they use are essential in developing a customer relationship. Managers claim that the most used distribution channels are the official hotel and social media sites, namely Facebook. However, there are some differences between the two: if EMD uses promotional flyers to attract customers, this does not apply to Courtyard by Marriott. They have a program called the Marriott Rewards Program that rewards customers with bonus points based on the services they purchase, points that can be used later in any hotel in the Marriott chain for the same purpose.*

Question no. 5: What are the objectives of the EMD Tennis Academy Bacău / Courtyard by Marriott hotel complex regarding customers?

Interpretation: *The objectives of hotels regarding customers are to attract them to use their services by offering them a unique experience in hotels. Their goal is to actually get customers who want to return to these hotels because of the degree of satisfaction they have gained from purchasing these services. Hoteliers also believe that a satisfied*

and satisfied customer will attract other customers, thus creating a continuous flow between loyal customers and potential customers.

Question no. 6: What is the strategy applied in relation to customers?

Interpretation: *Both the answers to question 6 and the answers received in the interview to question 8 confirm the first hypothesis proposed.*

The first hypothesis was that hotel managers believe that the improvement of customer relations occurs as a result of the training of staff in the reception department, who have the greatest influence in creating a customer relationship.

The two interviewees of the research claim that the staffs in the front desk department are the one who has the greatest influence in the relationship with customers. For this activity, they choose people with communication skills and interaction with very high customers, people with a positive and detached spirit, people who are relaxed and eager to offer the best services to hotel guests. So they encourage their employees to interact with the guests in the most pleasant and friendly way possible.

Question no. 7: How does the EMD Tennis Academy Bacău hotel complex / Courtyard by Marriott Hyannis hotel aim to retain potential customers?

Interpretation: *This question fulfils the proposed secondary objective in which we want to find out which are the ways in which hoteliers want to attract as many customers as possible.*

According to the answers received from the two interviewees, I noticed that the EMD Tennis Academy Bacău hotel complex focuses on promoting leisure services, which attract potential customers due to a wide range of activities that can take place inside the hotel, in time. The Courtyard by Marriott Hyannis hotel focuses on the Marriott Rewards Program and rewards Elite member customers by offering those discounts at any hotel in the Marriott chain.

Question no. 8: Is it true that front desk staff has a certain influence on customer relations? If so, in what way?

Interpretation: *As I specified, the answers to this question confirm the first hypothesis regarding the importance of the reception staff.*

Both answered this question in the affirmative, considering that the first impression that customers get when they choose to purchase the services offered by these hotels is given by the staff of the front desk department. Managers claim that the recipients are very well trained and knowledgeable to give customers a flawless picture of the services they have purchased or are about to purchase.

Question no. 9: What improvement strategies do you think EMD Tennis Academy Bacău / Courtyard by Marriott Hyannis should apply to customer relations?

Interpretation: *Question 9 refers to the main objective proposed and due to the answers received it has been met.*

Regarding the EMD Tennis Academy Bacău hotel complex, they consider that the application of customer loyalty strategies will improve the relationship with them. As a loyalty strategy they want to implement the *customer loyalty strategy* through co-branding. As the Bacău karting track is in collaboration with the EMD Tennis Academy Bacău hotel complex, hoteliers will offer guests free access to the leisure karting track throughout their stay at the hotel. This strategy will increase sales and the quality of tourism services offered. They also practice the strategy of improving the way they conduct contact. They designate employees with good behavioural and

communication skills to interact with customers in order to enhance relationships with them.

On the other hand, thanks to the loyalty programs Rewards Members Program and Elite Member that it uses, the Courtyard by Marriott hotel aims to practice the strategy of the ambassador client. This consists of selecting loyal customers from within the hotel and decorating them with the brand ambassador status. This strategy will help to improve the relationships with customers or potential customers through loyal customers who share their own experiences in the hotel, promoting the services offered by it.

At the same time, the Courtyard by Marriott is a hotel that conforms to the standards and principles of the Marriott hotel chain, with a higher flow of customers, being possible here to use loyalty programs and offer the status of elite members to those customers who constantly frequent its services.

5. Conclusions

Following this interview we found that the second proposed hypothesis was confirmed, so although both hotels are rated 4 * and offer the same range of tourist services, they practice different customer loyalty strategies, which is due to the small capacity of accommodation on which the EMD Tennis Academy hotel complex owns compared to the Courtyard by Marriott Hyannis hotel.

Customer relationship management symbolizes the *maintenance, development and optimization of relationships between a hotel and its customers*. It focuses on meeting the wishes and needs of customers who are always at the heart of developing a long-term relationship with them. The strategies applied by the analysed hotels are based on *customer loyalty* and improving relationships with them, but at the same time managers must take into account the competition strategies that are often the same, always having to come up with innovative ideas to attract and maintain consumers.

In conclusion, following the qualitative research conducted, we managed to achieve both the proposed objectives. The achievement of the main objective of finding out what, in the view of employers, are the strategies to improve customer relations in the provision of tourism services was achieved with the help of the answers received during the interview. At the same time, the secondary objective in which we wanted to find out the ways in which managers want to apply these strategies to attract as many customers as possible and to meet the needs, desires and requirements of guests during the use of services was met tourist.

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THE U.N. GLOBAL GOALS AS OPPORTUNITY AND THREATS FOR ENTREPRENEURS' WELL-BEING IN A POST COVID PERIOD

Dr. Edita Jurkonyte

Kaunas University of Applied Sciences, Kaunas, Lithuania
edita.jurkonyte@go.kauko.lt

Rob de With

Founder ATWORKSOLUTIONS & GlobalGoals.community, Breda, the Netherlands
rdewith@atworksolutions.nl

Dr. Ioseb Gabelaia

RISEBA University of Applied Sciences, Riga, Latvia
ioseb.gabelaia@riseba.lv

Abstract. The well-being of entrepreneurs has long been an indispensable topic in the field of entrepreneurship. Entrepreneurs engage in an increasingly vital role in the wealth creation of today's culture. It often energizes positive change in society providing breakthrough innovations that contribute to well-being. Hence, examining well-being and understanding the potential entrepreneurial behaviors will guide many to psychological well-being. Due to United Nations speeding up the process of implementing the Global Goals a new stressor for entrepreneurs appears. New regulations, investments, and even new value propositions for all businesses must be developed to follow regulations or even survive. Entrepreneurs are tasked to change their businesses dramatically from money-driven to impact-driven. A business meets requirements towards the right balance between economic and social value. Moreover, due to Covid-19, the risk has become even higher in the last two years. Additionally, after implementing a talent scan, the ME-scan including an outcome of the most suitable Global Goals, the entrepreneurs became aware of and better used, their talents. A team effort can be increased, a sustainable strategy can be developed for the enterprise owned by the entrepreneur. The study was aimed to explore mental well-being amongst entrepreneurs, knowing that in practice defining actual measures of well-being is a difficult task. An extensive review of available literature, journal articles, etc. was conducted. A quantitative research methodology was selected as a desirable approach to analyze data. Based on a survey on entrepreneurship well-being the reasons for the mental disease were obtained. Overall, 283 respondents confirmed entrepreneurs are at risk for mental disease. It was observed that there is a positive relationship between the impact of entrepreneurship on mental well-being. Results indicated that a large majority of the respondents still gave a positive rating of their mental well-being, as well as an overall positive link between their professional activities and their mental well-being. Further, with mental distress, most entrepreneurs turn to family, friends, and personal contacts with other entrepreneurs as their main sources of support.

Key words: *Mental Well-being, Entrepreneurship, Sustainability, SME, UN Global Goals*

1. Introduction

Entrepreneurship is a thrilling but risky business whether in times of certainty and/or uncertainty. Today, the pandemic disrupted many plans and changed the priorities of future endeavors. In this threatening environment, mental health especially for entrepreneurs has become more under pressure.

Mental health describes cognitive, behavioral, and emotional well-being. Hence, it can affect daily relationships and physical health. Moreover, mental health can sustain the power to enjoy life. Furthermore, conditions such as stress, depression, anxiety, etc. disrupt daily work-family routines.

In above mention context, it is critical to think about the mental health of entrepreneurs. Entrepreneurs are tasked to balance life activities and responsibilities while trying to achieve established professional goals. Moreover, limited working capital means increase mental health disorders. Besides, limited support for entrepreneurs creates a dip where enterprises are on the edge to give up on ideas, projects, etc.

The process of setting up a new business, bearing risks, and enjoying the outcomes requires mental strength. Entrepreneurs are not born with the ability to overcome daily stressors. Working with innovation, new ideas, collaborations, etc. requires much more than we can see.

Covid-19 impacted small and medium-size enterprises, but not only. It brought more vulnerability to entrepreneurs, as leading crises and entrepreneurship demands a lot of mental health. Moreover, uncertainty surrounding the covid-19 increased awareness of how society looks and discusses entrepreneurs' mental well-being. However, it should be noted that the pandemic forced and encouraged a new generation of entrepreneurs. Due to new technologies and curiosity about new job structures, multiple levels of new ideas have emerged.

The study aimed to explore the relationships between entrepreneurship and mental well-being. Around 300 respondents from several countries were invited to complete the survey and share their thoughts. To navigate new normal, business and not only, must be aware of transitions in various industries and how they impact mental well-being. In this environment, we should monitor the cognitive, behavioral, and emotional elements of individuals.

Unfortunately, in the era of fast-developing technologies and constant sustainable pleasure, everyone is at risk of developing mental illness, no matter of sex, age, ethnicity, income, or lifestyle.

2. Literature Review

- Sustainability and economic growth -the integration and balance of social, environmental, and economic needs – is a salient concern for sustainable development and social well-being (Divito & Ingen-Housz, 2021).
- Due to its wide-ranging relevance across scientific fields, empirical research on well-being has proliferated in recent decades. Researchers in entrepreneurial studies are increasingly interested in the psychological well-being of entrepreneurs (Ryff, 2019). Furthermore, well-being is an essential outcome of engagement in entrepreneurship, but the pathway is poorly understood (Nikolaev, Boudreaux, & Wood, 2022).

- Interest in entrepreneurs' mental health and well-being is growing in recognition, however, relevant knowledge is dispersed across disciplines and yet unclear (Ute, 2017). Moreover, according to Johansson Seva, Vinberg, Nordenmark, & Strandh (2016), knowledge of well-being among the self-employed, and the potential influence of contextual factors are somewhat limited. Moreover, according to To,
- Guaita Martínez, Orero-Blat, & Chau (2020), intentions are mental suggestions related to the pursuit of expected purposes and need motives to propel actions to accomplishment. In regards, to entrepreneurship, there have been debates on motivations' significance and intentions on how to accomplish starting goals.
- Well-being is generally defined as a state of being happy, healthy, and comfortable. However, it is a multifaceted, broad concept with many nuances, it encompasses both physical and psychological positive states of being (Lanivich, Bennett, Kessler, McIntyre, & Smith, 2021). Moreover, Giraldo, Farcia-Tello, & Rayburn (2020) elaborate more that well-being indeed is a multi-faced concept that relates to emotions of hedonic and eudaimonic well-being. Lastly, Ryff (2019) recognizes that entrepreneurial activity, by definition, is self-initiated and hence is fundamentally tied to ideas of autonomy and independence.
- Entrepreneurs face many stresses as they start and run their ventures (Lerman, Munyon, & Williams, 2020). Moreover, the stressors can be coded as either challenges or hindrances and each stressor differently influences entrepreneurs' well-being and venture performance. Additionally, Bencsik & Chuluun (2021) indicate that self-employed also report more health problems and physical well-being.
- According to Bujacz, Eib & Toivanen (2019), profiles of well-being are likely associated with demographic and work-related characteristics, meaning that some characteristics may make it more likely for an individual to develop a certain well-being profile. Job satisfaction, work engagement, and work burnout are well-recognized dimensions of work-related well-being. Together, these elements of work-related well-being paint a comprehensive picture of how entrepreneurs might develop positive feelings about their work, or avoid negative feelings, due to the social value that they generate through their business endeavors (Brieger, De Clercq, & Meynhardt, 2021).
- It is important to note that psychological well-being has emerged as an interesting phenomenon in entrepreneurship (Gorgievski & Stephan, 2016). Besides, individuals pursuing entrepreneurial careers face a distinct set of job stressors and pressures such as greater risk-taking and job uncertainty while also enjoying benefits like greater decision autonomy and talent actualization that impact psychological well-being (Marshall, Meek, Swab, & Markin, 2020). Moreover, due to its effects on psychological autonomy, entrepreneurial work is also more likely to lead to greater feelings of personal mastery and competence, or core self-efficacy, than non-entrepreneurial work (Shir, Nikolaevc, & Wincent, 2019).
- Interest in the subjective well-being of individuals, including those that choose entrepreneurship (or self-employment) as an occupation, has risen in recent years (Amoros, Cristi, & Naude, 2021). According to Shir, Nikolaevc, & Wincent (2019) entrepreneurship grants opportunities for self-motivated skill utilization and continuous learning, which are vital for feeling effective.

- Entrepreneurs play an increasingly important role in the wealth creation of today's society. Moreover, examining entrepreneurial intentions can improve understanding of the potential entrepreneurial behavior (Zhang, Wang, & Owen, 2019). Further, individuals are drawn to entrepreneurship by the allure of extrinsic and intrinsic rewards, security (for self and family), and self-sufficiency (Lanivich, Bennett, Kessler, McIntyre, & Smith, 2021).
- Entrepreneurs experience more flexibility in their working lives and find their jobs more satisfying (Xu, He, & Yang, 2021). Moreover, it has been widely recognized that digital trends create new opportunities for entrepreneurs, as well as risks for well-being (Torres & Augusto, 2020).

3. Research Methodology

This study examines the importance of mental well-being amongst entrepreneurs. Quantitative research methods were used to gather and analyze obtained data. The available literature on mental well-being and psychological distress among entrepreneurs was explored and an initial (English) survey was devised. Further, the first draft was pretested among the project partners, and thus modified based on their feedback. Lastly, the final version was translated into Dutch, Lithuanian, and Portuguese languages. Qualtrics survey tool was used for data gathering.

Survey invitations were mailed to the project partners in May 2021. This was done through a variety of channels, including a direct mailing to about 7,000 companies. A reminder mail was sent to those companies towards the end of May.

During the analysis phase, the SPSS27 was used to obtain the various descriptive statistics mentioned in the research findings and analysis below. In addition, Ordinary Least Squares (OLS) regressions were performed to detect significant relationships between different variables.

4. Research Findings and Analysis

Overall, 283 respondents participated in the survey on entrepreneurship and mental well-being, either completely or partially. Due to the dropouts, the actual respondent number may differ from question to question. 58% of the respondents in the sample were female, with varying roles in the company. More specifically, most of the respondents were owners and/or CEO of the company. Additionally, authors identified 57 board members, either of a board of directors or a board of advice.

Many of respondents were in age group 41- 60, with over 80% of them having received a bachelor or master level education. Regarding the respondents' workplace, a sample contained data from 12 countries, with most of the respondents working in Belgium (35%) and Portugal (27%), followed by Lithuania (10%), the UK (6%) and the Netherlands (1%).

Over a quarter of the respondents are employed in the service sector. Education is the second most important industry sector (14%), while approximately 11% of the respondents are employed in trade or in the social economy (Figure 1).

The sample representatives were from small and medium enterprises. Over 42% employed between 2 to 9 people (including the respondent), while 29% of the companies between 10 to 49 employees. Moreover, 14% were one-man businesses.

Besides, the mean company age in this sample was 27 years. On the other hand, the mean respondent's tenure in his or her current company was 15 years.

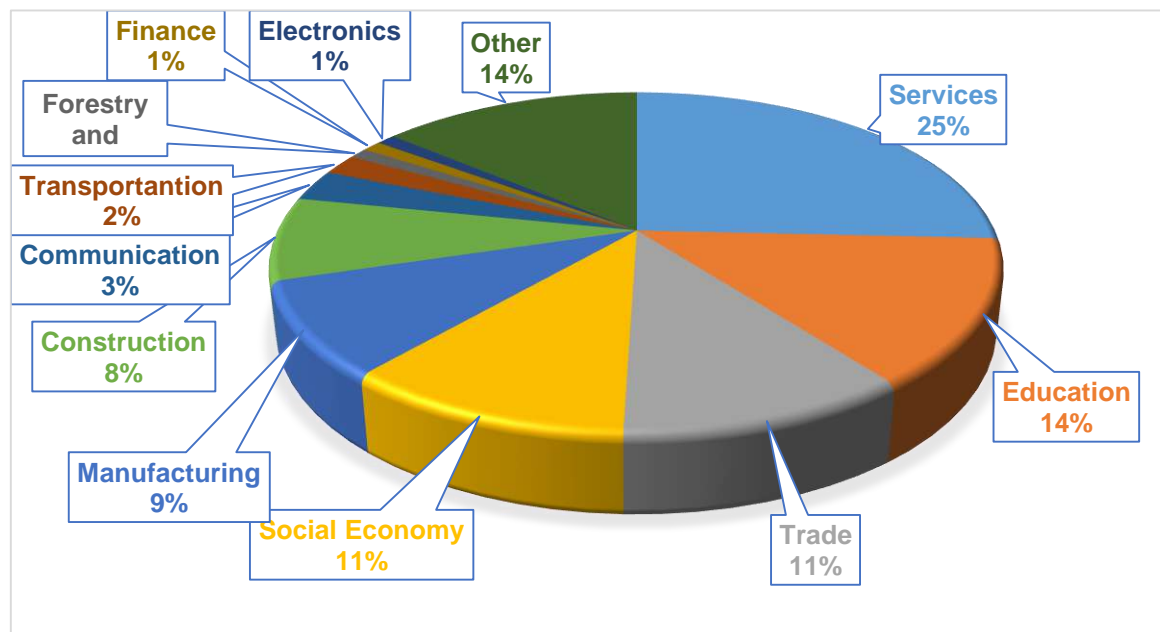


Figure 1 Industry Sector

4.1. Mental Well-being

To examine mental well-being amongst entrepreneurs' respondents', authors used three alternative measures:

- First, the respondents provided an overall rating of their state of mental well-being, both before and after the COVID-19 outbreak, on a Likert scale ranging from 1 ('Not good at all') to 6 ('Very good').
- Second, the short, 12-item version of the General Health Questionnaire (GHQ-12) was used. This measure consisted of 12 questions with answer categories ranging from 1 to 4 (Gorgievski, Bakker, Schaufeli, van der Veen and Giesen, 2010; Griffith and Jones, 2019).
- Third, a measure of mental well-being included 4 items from the Short Form Survey Instrument (SF-36) (Rand, 2021). Namely 'During the past 4 weeks, have you had any of the following problems with your work or other regular daily activities because of any emotional problems (such as feeling depressed or anxious). Each of the items included could be answered with 'Yes' or 'No'. It was called a measure 'SF-4'.

Figure 2. highlighted the distribution of the respondents' answers to general measure of mental well-being. As a result, a large majority of the respondents gave a positive rating of their mental well-being, although it was observed a noticeably negative shift since the start of the COVID pandemic.

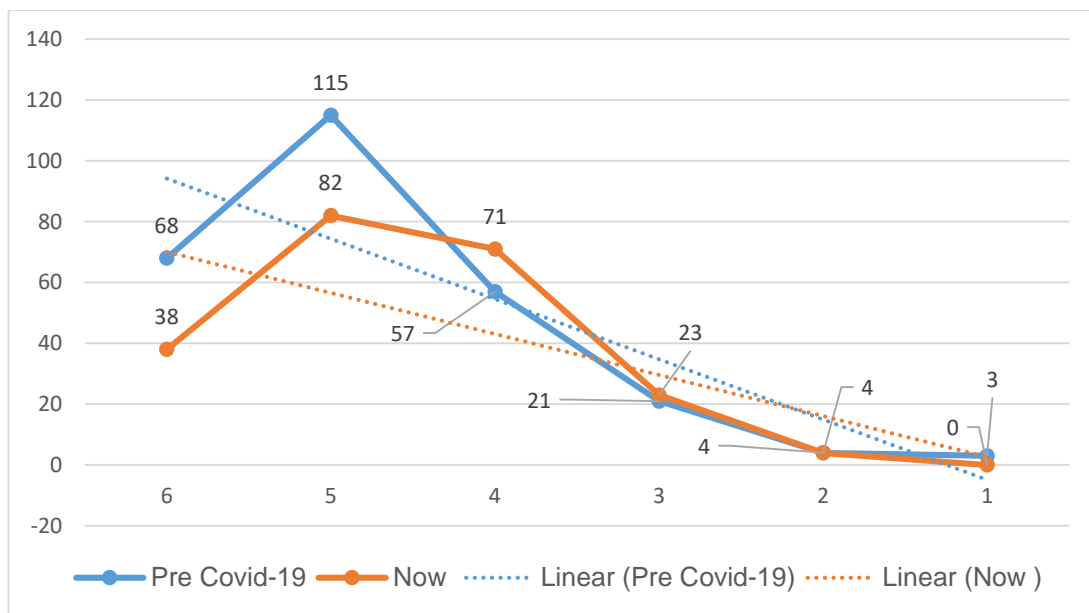


Figure 2 Overall Mental Well-being (Pre-Covid vs Now)

Table 1 below reveals the results of our two alternative measures, the GHQ-12, and the SF-4. Instead of taking the sum of the different sub-items of each measure, authors opted to calculate the mean to avoid distortions due to missing data. Hence, the GHQ-12 measure possibly ranged from 1 to 6, while the SF-4 ranges from 0 to 1. Contrary to the general measure of mental well-being, for both the GHQ-12 and SF-4 lower values represented a good state of mental well-being. Further, with a mean value of 2.2, the GHQ-12 yielded a generally positive result that confirmed the answers to general question regarding mental well-being. Likewise, the SF-4 measure also showed a positive picture, with a mean value of only 0.4.

Table 1 Mental Well-being.

	GHQ-12 (Mean)	SF-4 (Mean)
<i>Mean</i>	2.21	0.40
<i>Median</i>	2.08	0.25
<i>Maximum</i>	3.92	1
<i>N</i>	272	254

A correlation analysis of three different measures of mental well-being further confirmed that all of them are significantly correlated, indicating the respondents answered consistently across the different sets of questions.

Lastly, regressions analyses were performed on each of the measures of mental well-being to discover any potential links to the respondents' gender, age, or education level, as well as to their workplace (location), their company size or their organisation being a non-profit or a for-profit organisation. However, in overall, the results revealed no significant differences between the subgroups.

In addition to measuring the mental well-being, authors asked respondents whether, during the past year, they had considered giving up entrepreneurship or switching to another industry sector. Figure 3 below, highlighted a positive relationship. Most entrepreneurs were determined to continue their operations in the same sector.

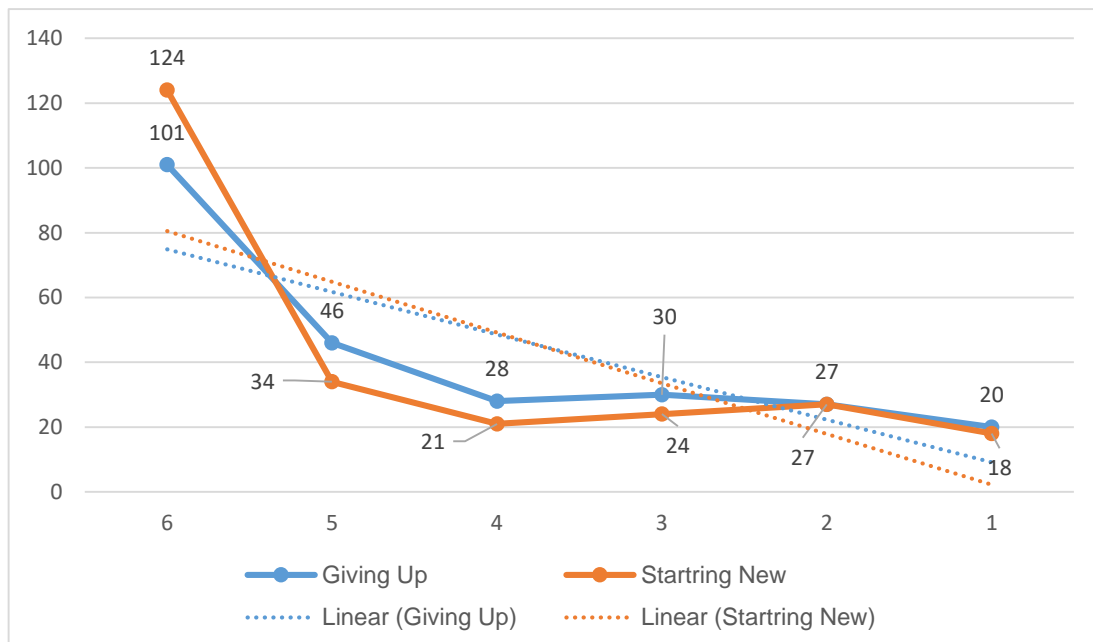


Figure 3 Giving Up vs Starting New Relationship

4.2. Entrepreneurship and mental well-being

For many entrepreneurs, their company represents a source of professional and personal fulfilment as well as autonomy. At the same time such a commitment is accompanied by responsibilities and the potential to decrease one's well-being.

To assess whether entrepreneurship has a positive or a negative impact on mental well-being, respondents were asked to what extent they consider their entrepreneurial activities linked to their state of mental well-being. The range differed from 'Extremely negative (professional life worsens mental well-being)' (value of 1), over 'Not at all' (3) to 'Extremely positive (professional life improves mental well-being)' (value of 5). On average, the entrepreneurs reported a slightly positive link between their professional activities and their mental well-being, with a mean and median score of 3.5 and 4 respectively.

Additionally, the entrepreneurs were asked for a more detailed perspective by enquiring how strongly different categories of professional problems decreased their mental well-being, on a scale of 1 ('Not at all') to 6 ('Very much'). The results indicated that financial problems as the main source of worries, with a mean score of 4.3 out of 6. Problems with employees and problems related to sales were ranked second and third, both with a mean value of 3.6.

4.3. Coping with Psychological Distress and Need for Additional Support

When faced with psychological distress, people may have different options that can help or support them. Such support may come from their personal or professional

network but also from government organisations. In our survey, eight questions were dedicated to sources of support and asked entrepreneurs to assess how helpful those had been to avoid, cope with or relieve psychological distress during their entrepreneurial activities, on a scale of 1 ('Not helpful at all') to 6 ('Very helpful').

Following results were obtained: family was a very important source of support when problems arise (mean value of 5.1), closely followed by friends (4.8) and personal contacts with other entrepreneurs (4.5). Professional activities and seminars were fourth and were also deemed helpful by most of the respondents (3.8). Opinions were divided about the usefulness of formal education and professional psychological help. Finally, non-profit organisations and especially government organisations were not generally viewed as helpful by most of the entrepreneurs.

Further authors explored whether the importance of different sources of psychological support depended on the respondent's characteristics (gender, age, education level, workplace (location), company size and non-profit versus for-profit organisation).

The results showed little impact of respondents' characteristics, except for country (workplace) effects.

- UK respondents showed significantly less reliance on family and friends as sources of support than respondents in other countries.
- Lithuanian respondents on the other hand, showed significantly more appreciation for formal education, government organisations and non-profit organisations as mechanisms to avoid, cope with or relieve psychological distress.
- The latter appreciation (non-profit organisations) was shared by Portuguese respondents, while Belgian respondents shared Lithuanians' appreciation of government organisations.
- One non-country effect does however stand out, as older respondents rely significantly more on formal education as a helpful tool to avoid or cope with mental distress than their younger counterparts.

It can be argued that the usefulness of some sources of psychological support depends on the situation and, more specifically, on the kind of problems causing psychological distress. Therefore, authors checked the impact of the answers to the previous set of questions, i.e. 'To what extent do the following professional problems decrease your mental well-being?'

The regression results indicated following relationship:

- First, respondents that signal a high negative impact of financial problems on their mental well-being mention friends as a significantly more important, more helpful point of support.
- Second, coping with employee problems as a major source of psychological distress, respondents found both the formal education system and government organisations to be significantly less useful as support or coping mechanisms.
- Lastly, non-profit organisations were deemed to be significantly less important as a source of for those that report a high negative impact of administrative problems on their well-being.

For those respondents without previous experience the main barriers seem to be the time they take up, especially about formal education, and the difficulty of finding the

appropriate support, especially when provided by non-profit or government organisations highlighted on Table 2 below.

Table 2 The main reasons preventing from participating in/using the resources

	I don't need it	I don't know where to find it	Too expensive	Too time-consuming	Shame
<i>Formal education</i>	41	4	11	28	0
<i>Activities by professional entrepreneurial organisations</i>	10	8	6	18	0
<i>Government organisations</i>	39	18	0	14	1
<i>Non-profit organisations</i>	39	24	0	10	3
<i>Professional psychological help</i>	73	6	13	11	5

To identify additional knowledge or learning materials that could be useful for entrepreneurs to achieve or maintain a healthy work-life balance, respondents were given seven different options to assess on a scale of 1 ('Not at all') to 6 ('Very much'). Additional knowledge about psychology and mental well-being was most useful by the respondents (mean score of 4.1 out of 6), followed by management or planning knowledge (mean score of 4).

After analysing the correlation in relationship with background characteristics, following results were seen:

- Firstly, there was a country effect regarding the reported need for knowledge regarding financial or accounting matters, which is significantly higher in Portugal, Lithuania, and the UK.
- Secondly, an age effect with younger respondents expressing a significantly higher need for knowledge on psychology and mental well-being and older respondents seeking more marketing-oriented knowledge.
- Finally, a higher education level was significantly related to a higher need for knowledge regarding management and planning issues.

Furthermore, respondents had asked them to indicate how interested they would be in specific forms or methods, on a scale of 1 ('Not at all') to 6 ('Very much interested'). Although most of the respondents were favourable to all the different forms listed, actual case studies and testimonies by actual entrepreneurs emerged as the best way to distribute new knowledge (mean score of 4.1 out of 6). The second-best was a mentorship with other entrepreneurs, confirms this preference for peer-learning (mean score of 3.9), followed by the three formal forms such, educational methods, live online courses and recorded online courses. The least interesting forms were networking events and self-study by means of an information web platform.

A more in-depth analysis revealed little significant differences between different groups of respondents, apart from some limited country-specific effects. Belgian respondents to be less interested in both live and recorded online courses or seminars, while

Lithuanian and Portuguese respondents are more interested in topical networking events.

5. Conclusion

The Covid-crisis has undoubtedly made the previous two years stressful for entrepreneurs. However, even under such circumstances, our survey shows a large majority of the respondents still giving a positive rating of their mental well-being, as well as an overall positive link between their professional activities and their mental well-being.

When confronted with mental distress, most of the entrepreneurs in our survey turn to family, friends, and personal contacts with other entrepreneurs as their main sources of support. On the other hand, formal education and professional psychological help, as well as non-profit or government organisations are generally viewed as being less helpful.

A self-assessment as used in the Me-scan will be helpful for entrepreneurs to get an objective overview of their own talents. Based on the scan outcomes the positive rating of entrepreneur's mental well-being are expected to be effected in a slightly negative direction. Self-knowledge should be the basis for further knowledge development.

The entrepreneurs in our sample would appreciate additional information about psychology and mental well-being, as well as more elaborate management or planning knowledge. For most entrepreneurs, the ideal way to obtain such information would be through peer-learning, such as actual case studies and testimonies or via mentorship with other entrepreneurs.

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BUSINESS INFRASTRUCTURE INFLUENCE ON REGIONAL COMPETITIVENESS AND DEVELOPMENT

Ramona FLOREA

George Bacovia University in Bacău, Romania
ramona.florea@ugb.ro

Radu FLOREA

George Bacovia University in Bacău, Romania
radu.florea@ugb.ro

Abstract. Increasing regional competitiveness became during the last decades one of the major concerns of regions all around the world. In fact, external environment, characterized by the acute energy crisis, lack of resources, Covid-19 pandemic and its economic, social effects and limited access to financial and qualified human resources led to an increased competition between regions in order to attract investment and human resources. Local communities and regions all around the world are permanently struggling for increasing their attractiveness and competitiveness in order to attract foreign investments, different sources of financing, companies and high-skilled people.

Regional competitiveness is the ability of a region to provide an attractive and sustainable environment for businesses and residents to live and work there. European Commission identified the main characteristics of competitive regions: significantly developed infrastructure (for industry, services, transport, IT and connectivity, research - development, culture, education health, social activities), high skilled human resources and an inclusive climate and efficient and responsible governance and a good reputation.

Regional competitiveness can be analysed from three different perspectives: one of the companies and investors, one of the inhabitants, and one of different stakeholders (NGOs, local communities) interested in community development and prosperity.

This paper aims to present different approaches of the concept of regional competitiveness and the main factors which influence regional competitiveness, also called the “sources of competitiveness”, focusing mainly on business infrastructure and investments.

The experience of the past decades shows us that, most of the time, business infrastructure represents a major factor of the economic, cultural and social development of the region. The business infrastructure allows attracting investors, developing businesses in the area, creating new jobs and, as a consequence, increasing the demand for products and services in all activity sectors (including culture, education, health). There are other situations when the lack of adaptation of the business infrastructure to the particularities of the region (related to the economic potential, insufficient qualified human resources) will not produce the expected economic and social effects.

The paper analyzes the impact of business infrastructure (including industrial, technological parks, production units, business incubators, business centers, economic centers, offices, exhibition areas) on economic development, environment, resource-saving and sustainable development of the region.

Key words: *regional competitiveness, strategic management, local development, business infrastructure, local communities, strategic objectives*

1. Introduction

External environment, characterized by the acute energy crisis, lack of resources, Covid-19 pandemic and its economic, social effects and limited access to financial, material and human resources led to increased competition between regions in order to attract investment and human resources.

In this sense, communities are permanently concerned about increasing the attractiveness and competitiveness of the region by creating and ensuring the most attractive working and living conditions for companies and their workforce. Local development strategies must aim at analysing and increasing the level of regional competitiveness.

Regional competitiveness is the ability of a region to provide an attractive and sustainable environment for businesses and residents to live and work there. (Annoni and Dijkstra, 2019)

Thus, in recent decades we have witnessed dramatic upheavals. Regions that were considered very attractive, true poles of local development, were outperformed by others that, through strategies to attract and maintain financial and human capital in the area, managed to achieve growth rates well above their country or region.

These regions are mainly defined by:

- Developed, high-performance business infrastructure that attracts multinational companies, investors and creative SMEs
- Transport infrastructure, services, IT that allows the connection of the region and ensures the transfer of goods, people and information
- Developed and diversified system of education and long-life learning that provides companies with sufficient and quality human resources, access to research outcomes and the development of partnerships between business and scientific world.
- Education, health and culture infrastructure that ensures a high level of quality of life and that attracts and maintains investors, innovative SMEs, young people, employees and high-performing experts in the area. (Lopez-Claros et al., 2006)

Competitive regions are also characterized by higher levels of productivity and employment.

Regional competitiveness can be analysed from three different perspectives: one of the companies and investors, one of the inhabitants, and one of the different stakeholders (NGOs, local communities) interested in community development and prosperity.

2. General Consideration regarding Regional Development and Regional Competitiveness Index

Regional competitiveness has resulted as an extension of the concepts of performance and competitiveness, specific terms to the business environment, to the administrative area and regional development.

Regional/national competitiveness concept had, over time, different approaches and methodologies including also different sets of indicators for measuring and comparing different worldwide regions competitiveness and performance.

The concept of Growth Competitiveness Index and its methodology was introduced by World Economic Forum in 2000. Regional competitiveness Index (RCI) was calculated for the first time in 2001, in Annual Competitiveness Report 2001 based on 200 indicators, divided in 11 main areas of analysis: Economical performances; Transport and infrastructure; Science and Technology; Computerization degree, Internationalization degree; Value and structure of capital; Education; Productivity; Remuneration and Workforce cost; Costs related to unprofitable companies; Taxes; Environmental protection framework and management. (Bobek et al., 2015)

In 2004 Gardiner identified the main factors having a direct influence over regional performance and competitiveness. According Gardiner's model ("Pyramidal Model of Regional Companies") regional competitiveness is determined by eight factors, called sources of competitiveness: economic structure, innovative activity, regional accessibility, environment, regional culture, urban scale, social structure and, last but not least human capital. (Gardiner et al., 2004)



Figure 1 Gardiner Pyramidal Model of Urban competitiveness (Gardiner et al., 2004, 19)

Gardiner considers that regional competitiveness is directly influenced by the regional potential (economic, technologic, social, touristic and cultural), the access of all the local resources and, also by the general development context. In his opinion, regional competitiveness is a consequence of the region's economic development as result of creating and developing high-performing start-up companies in the area that will increase the region's GDP and create new jobs. At the same time, the increase in the employment rate leads to an increase in the income of the population and, consequently, to an increase in the demand for goods and services and in the standard of living. (Gardiner et al., 2004)

Since 2010 the EU has been calculating the Regional Competitiveness Index (RCI) for it's 268 EU regions, territorial units for statistic NUTS 2.

The methodology for calculating RCI is based on the World Economic Forum (GCI-WEF) methodology used to determine the Global Competitiveness Index. The methodology and indicators have been continuously updated according to the evolution of the social, technological, cultural environment. (Florea, 2019)

Since 2016 Regional Competitiveness Index for the 268 EU regions is presented in an interactive online version and allows an analysis and comparison of each region with other regions achieving equivalent GDP or to all EU regions.

Updated every three years, most recently in 2019, the Regional Competitiveness Index allows regions:

- monitor and assess their evolution over time and comparing with other regions
- analyse their regional competitiveness in terms of the following aspects: innovation, governance, transport, digital infrastructure, health or human capital.
- identify their strengths and weaknesses compared to similar EU regions or other regions
- set their Local Development Strategy priorities
- prioritise public investments

The RCI is composed of 11 pillars describing different aspects of competitiveness. These pillars allow the strengths and weaknesses of a region to be assessed. The 11 pillars can be classified as follows:

1. **The elementary group** comprises five pillars: (1) institutions; (2) macroeconomic stability; (3) existing infrastructures; (4) health; and (5) basic education. These pillars are the essential basic drivers of all types of economies.

2. **The efficiency group** includes three pillars: (6) higher education, vocational training and lifelong learning; (7) labour market efficiency; and (8) market size.

3. **The innovation cluster** consists of three pillars: (9) technological maturity; (10) business sophistication; and (11) innovation. (Annoni & Dijkstra, 2019)

Each of these indicators is assessed on the basis of other indicators, which reflect the directions of action to be implemented.

3. Some figures regarding RCI in EU countries

On 7th October 2019, the European Commission published the Regional Competitiveness Index Report 2019 (RCI) and a Eurobarometer survey on regional policy. These publications offer to EU states important information for designing future cohesion policies for the 2021-2027 period. They will also help Member States authorities to understand public opinion, to identify and better target investments and resources. (Annoni & Dijkstra, 2019)

In calculating the index, the European Commission used a measurement system that takes into account the stages of development of all regions. European regions are divided into 5 stages of development, based on average GDP/capita from 2015-2017. For RCI calculation the European Commission has used sub-indexes according to stages of development, focusing on the aspects that are the most relevant for the region's development.

According to Regional Competitiveness Index Report 2019 Stockholm region has the highest ranking in the Competitiveness Index (100/100), followed by London (99,07/100), Utrecht (98,99/100), Berkshire, Cuckinghamshire and Oxfordshire – UK (98,59/100) and Surrey, East and West Sussex-UK (98,38).

Leading regions are characterized by a developed infrastructure and business environment, a high rate of innovation and business sophistication correlated with a performant high education system.

The last place is occupied by the Voreio Aigaio region in Greece, and the penultimate place is held by the South-East region in Romania.

Unfortunately, Romania's regions, except Bucharest-Ilfov, are at the bottom of the ranking according to Regional Competitiveness Index, as presented in Table no.1.

Table 1 Romanian EU regions RCI&GDP ranking/268

Country	Region	RCI/100	RCI ranking/268	GDP ranking/268	Development Stage
Romania	Bucharest-Ilfov	55.92	151	25	5
Romania	West	20.90	238	222	2
Romania	North-West	17.45	246	244	2
Romania	South-Muntenia	15.62	247	257	1
Romania	Centre	13.18	249	240	2
Romania	South-West Oltenia	10.57	254	254	1
Romania	North-East	9.05	257	264	1
Romania	South-East	5.35	267	249	1

(Source The EU Regional Competitiveness Index 2019)

Comparative analysis of the RCI of Romania and the 8 EU regions and similar regions according GDP or geographical position, leads to the following conclusions:

- Romania's national average RCI is 17.84 out of a maximum score of 100 points, reflecting low national competitiveness and attractiveness.
- Other Central and Eastern or Southern European countries have considerably higher Competitiveness Index than Romania: Greece (23.53), Bulgaria (25.8), Croatia (32.29), Hungary (39.78), Italy (42.1), Poland (42.77), Slovakia (44.01), Lithuania (44.72), Czech Republic (60.17), Slovenia (60.93).
- All Romania's regions, except Bucharest-Ilfov, are at the bottom of the ranking (238th to 267th out of 268 regions).
- Bucharest-Ilfov is the only Romanian region in the highest stage of development (5), while only three regions reach stage 2 - Centre, West and North-West - and the other four are at the lowest level of development (1).
- Even Bucharest-Ilfov is the best-positioned region in Romania, with a score of 55, 92 points, it remains far behind regions with a comparable GDP per capita. This score of 55.92 places the Bucharest-Ilfov Region on the 151st place out of 268 European regions, although in terms of GDP the region ranks 25th.
- In terms of competitiveness, the Bucharest-Ilfov region is similar to Vienna, Antwerpen, Karlsruhe, Prague, but has weaknesses in terms of institutions, infrastructure, health, basic education and technological maturity and innovation.
- The Bucharest-Ilfov region does not have any indicator superior to similar regions in the EU, according to the Competitiveness Index.

4. Business Infrastructure and its impact on regional development

As it has been proven above, apart from Bucharest, all the other regions in Romania present decreased levels of competitiveness and regional attractiveness. This is mainly due to the numerous liabilities from economic, educational and social standpoints.

Among the 50 most competitive regions in the EU, we can notice that these are economic development hubs that possess state of the art transport, industrial, educational and research infrastructure. Many of these regions have witnessed spectacular development in the last 50 years as a result of an industrialization process following investments in business, research and educational infrastructure.

The analysis of the most competitive regions in the EU shows us that regional attractiveness is closely tied to that region's capacity to attract performing innovative companies, as well as a highly qualified workforce.

Attracting capital and investors is directly conditioned by two aspects:

- Development strategies aimed at attracting investments, offering facilities and incentives and other types of support for companies wishing to invest, to start up new businesses, to relocate
- Developing on a regional scale a business infrastructure, aside from the transport, education and research infrastructure that can attract in the area large companies or start-ups, universities, research institutions etc.
- Creating and developing social, health, cultural and education infrastructure that would make the region attractive and would determine attracting and maintaining the human resources in the area.

Until now, the authorities focused mainly on developing transport infrastructure, considered as the decisive element or as the key to unlocking regional development and investors attracting.

Actually, without a developed business infrastructure and a series of solid policies and facilities for the investors, the transport infrastructure cannot attract and hold the capital, investors and human resource alone. A concluding example is the case of the North-East Region, formed of 6 counties, that disposes of a developed railway infrastructure, 3 international airports and a road system that comprises European, national and county roads but lacks highways and thus the connectivity they provide, leading to its placement on the 257th place in the Competitiveness ranking. This position reflects a reduced attractivity and a decreased capacity of attracting investments and human resource, caused mainly by a business infrastructure incapable to meet the demands of local businesses without having considered the idea of attracting new investors.

Regarding the human resource, the North-East Region has been facing in the last 20 years a massive migration process towards developed regions of Romania or abroad. This situation has been attributed to the poor development of regional transport infrastructure and the lack of highway-like road systems. The North-East region is the only region without any single functioning highway segment connecting the zone to the national and European road system. Actually, the reduced competitiveness of the region and the lack of attractiveness for investors and human resource is also due to a precarious development of business infrastructure, of industrial and technological

parks and business hubs that would allow concentrating the enterprises, attracting investors, developing new businesses and subsequently local economic development. Investments in regional business infrastructure have the goal of creating a framework for attracting investments in businesses and creating new jobs. These investments must answer to the needs of long-term regional economic growth and be integrated into the local, regional, national and European strategies.

United Nations Industrial Development Organization in “International guidelines for industrial parks” identifies the main objectives of an industrial policy: (UNIDO, 2019)

- Creating and developing business and manufacturing infrastructure
- Attracting new investments and promotion diversification process in innovative fields, facilitating exports;
- Increasing regional competitiveness, competitive advantage, productivity and regional development;
- Stimulating R&D and innovation, developing human resources potential and the introducing high technologies;
- Promoting environmental strategies and eco-friendly technologies in industry;
- Increasing employment and Gender and social inclusiveness;
- Improving the effectiveness of public service delivery.

The structures for supporting and developing businesses are the entities that secure the necessary environment for conducting economic activities and service provision by small and medium enterprises having the following objectives:

- Attracting investors in the production and services domain, generators of increased added value
- Capitalizing on the human and material resources potential in the area.

Among the structures for supporting businesses, we can mention: industrial and technological parks, warehouses, business hubs, centers of affairs, economic centers, offices, exhibition fairs, etc.

The industrial park is defined as per Law no. 186/2013 regarding the functioning of industrial parks, as a confined zone in which key economic, scientific research, industrial production and services activities are being conducted aiming to take advantage of the region’s human and material potential.

In 1997 UNIDO defined an industrial park as “a tract of land developed and subdivided into plots according to a comprehensive plan with the provision of roads, transportation, and public utilities, sometimes also with common facilities, for use by a group of manufacturers” (UNIDO, 1997)

Actually, the generic term of the industrial park includes a large range of different kinds of business infrastructures, having different functions and objectives and including different activities and operators. In 2016 Aggarwal attempted a classification of the most popular forms of organization and operation of industrial parks according to the activities carried out and the objectives pursued: (Aggarwal, A., 2016)

- *Eco-Industrial Parks* (Sustainable zones, Low-carbon, Green Zones, Circular zones) are industrial parks that aim to improve the social, economic, and environmental performance of their resident companies through promotion of green

technologies, resource efficiency, climate-resilient industries, sustainable and inclusive business, social responsibility.

- *Special Economic Zones* are regions or different geographical areas having different (favorable) regulations regarding customs tariffs and taxes.
- *Border Economic Zones* represent economic zones placed to the international borders, specially created for developing commercial exchanges and attracting investments.
- *Export Processing Zones* or Duty-free zones are special areas mainly for export manufacturing, trade activities, applying tax exemptions, and different grants for exports.
- *Free Trade Zones/ Free Zones* – areas with suspended or reduced duties and taxes for taxable goods in order to attract foreign investors, start-up business
- *Bonded Areas/Bonded Zones* special designed areas for storage and assembling activities without the payment of customs tax, subject to customs guarantees.
- *High-Tech Parks* are special areas designated to facilitate and promote the creation and growth of innovation-based companies through business incubation.
- *Agro-Industrial Parks* - areas designed to attract and promote industries in downstream agricultural processing.

Through the development of industrial parks, multiple aspects are being expected: direct investments in industry, services, scientific research from local or foreign investors, technological development and, development of large, medium and small enterprises, creation of new jobs.

The science and technology park is an area dedicated to educational, research and development activities, technological transfer of research results and their integration into economic activities.

Science and technology parks are set up with the aim of using the results of research and the application of advanced technologies in the economy and to increase collaboration between companies and universities, research and development institutions and the transfer of research results.

The main objectives of the Science and Technology Park are:

- technological transfer of research results to national companies
- training and involving young people in research activities;
- attracting national or foreign funding and investments for education and research activities;
- the exploitation of Romanian research results on the market;
- creating new jobs in the field of advanced technologies;
- stimulating creativity and innovative potential of academic staff and strengthening collaboration between academic and economic environment
- attracting companies to invest in technology transfer activities;
- developing scientific, technological and economic potential at the regional level

The science and technology park is established based on a joint venture contract concluded between higher education, research and development institutions, on the

one hand, and national companies, local administration, employers' or professional associations, individuals, Romanian or foreign investors, on the other hand.

5. Critical Remarks regarding Strategy of Industrial Park Development in Romania

In Romania at 26th April 2024 there were 104 registered industrial parks, public (50) or private (44) property, of which 17 are greenfields, 74 are operational and 13 are under construction.

In the 104 industrial parks occupying a total area of more than 3,400 ha, more than 79,400 employees work in more than 1,500 companies acting in the field of manufacturing (automotive industry, aerospace), logistic, storage ITC.

In 2002 the implementation of the legislative framework allowed the creation of the first industrial parks in Romania. Currently, the distribution of industrial parks is as follows: South Region (26), North West (23), Central Region (19), North East Region (8), South-West Region (7), West Region (12), Bucharest-Ilfov (7) and South East (2) (MDLPA, 2022) as presented in the Table no.2.

The analysis of the data presented, correlated with the level of GDP and the position in the EU regional competitiveness , shows that there is a direct link between the level of regional competitiveness and the number of existing industrial parks. Thus, the Bucharest, West and North-West Regions, which are the best ranked regions in the top of regional competitiveness, also have the largest number of active industrial parks.

Region/ RCI/268 GDP/268	Number of IP	Ownership			Location		Total Area	Number employees	Stage		
		private	public	mixt	urban	rural			Operational	Greenfield	Under construction
Bucharest- Ilfov RCI 151/268 GDP 25/268	7	7	0	0	3	4	152,28	11264	6	0	1
Centre RCI 249/268 GDP 240/268	19	8	9	2	14	5	555,99	14761	16	1	2
North-East RCI 257/268 GDP 264/268	8	1	5	2	3	5	154,15	1345	5	3	0
North-West RCI 246/268 GDP 244/268	23	9	13	1	18	5	806,99	24051	16	3	4
Sothd-East RCI 267/268 GDP 249/268	2	0	0	2	2	0	34,9	108	2	0	0
South- Muntania RCI 247/268 GDP 257/268	26	13	11	2	13	13	1288,85	24301	20	6	0

South - West											
RCI 254/268	7	0	7	0	5	2	127,92	2174	4	1	2
GDP 254/268											
West											
RCI 238/268	12	6	5	1	9	3	349,38	1406	5	3	4
GDP 222/268											
TOTAL	104	44	50	10	67	37	3470,46	79410	74	17	13

The activity and licensing of industrial parks is carried out centrally by the Ministry of Development, Public Works and Administration through the General Directorate of Public Administration, which is the specialised body of the central public administration responsible for industrial parks. An Interministerial Committee for Stimulating and Facilitating the Establishment of New Industrial Parks operates under the Ministry of Economy.

According to Law no. 186/2013 on the establishment and operation of industrial parks, the Ministry of Development, Public Works and Administration through the General Directorate of Public Administration has responsibilities for the development and implementation of strategies and policies to support the development of industrial parks.

However, the only data that exists at Ministry of Development, Public Works and Administration are related to the number of companies operating within the industrial parks, surface area, stage and utilities offered to companies within the industrial parks.

MDLPAT has no analysis regarding:

- average occupancy
- turnover achieved by companies operating within industrial parks
- indicators on the economic performance of companies operating in industrial parks
- sectors and fields of activity predominant among companies operating in IPs
- average number of employees and average earnings of employees
- the level of training of employees in industrial parks
- the type and size of companies operating in the IP

In the absence of this primary information, it is impossible to carry out an analysis on the efficiency of industrial parks, the efficiency of investments made with European funds, the impact of the existence of industrial parks on regional development, increasing the attractiveness and competitiveness of the area, the development of innovative sectors, bringing added value, creating jobs for highly qualified personnel and leading to a cascading development of the area.

At the same time, the lack of this information and analysis leads to the absence of a coherent strategy at national and regional level for the development of business infrastructure, attracting investors and high-performance companies in innovative, high added-value sectors that can have a significant impact on regional development and competitiveness.

In the absence of such a strategy, decisions on attracting investors and "populating" industrial parks are left to the park owners or managers. They will only take into account quantitative criteria (rent paid, surface area occupied, duration of contract,

etc.) and not qualitative criteria (linked to efficiency and impact on regional development in the medium and long term).

In this context, the main objective of the creation of industrial parks (to stimulate competitiveness and regional development, increase trade and develop a stimulating and performance-oriented climate) is secondary and up to discretion of industrial park managers. They have to choose between the economic performance of their industrial parks (judged by rental income, occupancy, etc.) and regional development (judged by the innovativeness, creativity and performance of the businesses that exist within the premises of the park).

In this respect, we consider that the existence of analyses and strategies and the establishment of priorities at national and regional level, derived from the national sustainable development strategy and regional strategies, is imperative in order to transform industrial parks into promoters of regional development and competitiveness.

6. Conclusions

We can conclude that, during the last decades, regional competitiveness became one of the major concerns of regions all around the world as it is strongly related to regional development. The analysis of the most competitive EU regions shows us that regional attractiveness is closely tied to that it's capacity to attract performing innovative companies, as well as a highly qualified workforce. In this respect, the 50 most competitive EU regions, are economic development hubs, having a well-developed transport, manufacturing, education and research infrastructure.

Moreover, business infrastructure represents a major factor of the economic, cultural and social development of the region as allows attracting investors, developing businesses in the area, creating new jobs and, as a consequence, increasing the demand for products and services in all activity sectors.

Considering these issues, we appreciate that local and regional authorities should focus on identifying and developing the most appropriate business infrastructure that corresponds to local potential, development strategy and the role of the region in the national economy.

They should also create and manage their own business infrastructure, especially industrial and scientific parks, according to their strategic priorities derived of their sustainable development and competitiveness.

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METHODS AND TECHNIQUES FOR ANALYZING USER REVIEWS ON THE INTERNET IN THE HOSPITALITY AND TOURISM INDUSTRY: A LITERATURE REVIEW

Danijela Perkušić Malkoč

University Department of Professional Studies, University of Split, Croatia
dperkusi@oss.unist.hr

Sanja Bašić Roguljić

University Department of Professional Studies, University of Split, Croatia
sbasic@oss.unist.hr

Karmen Glavinić

University Department of Professional Studies, University of Split, Croatia
karmen.glavinic@gmail.com

Abstract. Development of Internet technology and social media networks have moved consumers in the center of the communication process. Therefore, offering a new way of analyzing their satisfaction by giving direct feedback to the marketing management team. By analyzing consumer opinions through reviews, companies can get an insight from consumer perspective and improve their business. This paper evaluates the literature around methods for analyzing online user reviews in the hospitality and tourism industry. It covers 36 articles from peer-review journals and international conferences, dating from 2013-2022. The main contribution of this meta-analysis is to collect the current research of methods and techniques for analyzing user reviews on the Internet in the hospitality and tourism industry. In the introduction part of the article basic methods and techniques, mostly used for analyzing consumer reviews, were presented. After that, detailed analysis of the existing literature was performed according to criteria of data and sampling, research goal, methodology / technology, and data source. This paper contributes to the existing body of literature by summarizing mostly used techniques and tools for online consumer reviews in the hospitality and tourism industry. Practical contribution of this overview is reflected in usability of proposed methods by practitioners in order to better understand consumer preferences and to improve their service performance.

Key words: *Consumer reviews, sentiment analysis, text mining technique, tourism and hospitality industry*

1. Introduction

Every time someone stays in a hotel or has a dinner at a restaurant have the opportunity to leave their reviews online. These reviews not only help the service provider to realize what was good and what needs to be improved, they also help customers make a purchase decision by considering reviews of other customers. Instead of asking friends for their opinions and experiences with the product/service, which they may have never experienced, consumers today look for online reviews as a kind of electronic WOM (Word of mouth). However, due to the huge amount of online reviews, manually searching and summarizing the content of thousands of reviews becomes almost impossible task. In order to asses' reviews in a more efficient way

there are different machine learning techniques and algorithms that help companies collect and analyze customer reviews. One of the most popular technique is consumer sentiment analysis (SA).

Consumer sentiment analysis (CSA) using online reviews is a process of extracting whether a part of online reviews (product/services reviews, tweets, online surveys, etc.) is negative, positive, or neutral. It can be used to identify the consumer's attitude toward service by the use of words such as opinion, tone, context, etc. Organizations often use CSA to collect previous consumer experiences of their services or products and use it to improve their service performance (Chaturvedi *et al.*, 2018). CSA helps organizations to understand consumer satisfaction regarding their offerings, but it also provides a better understanding of how they lack from their competitors. It is also helpful for new consumers to gain knowledge about products or services before making purchase decisions (Jain, Pamula, & Srivastava, 2021).

This paper is based on a literature review of relevant papers investigating various methods and techniques for analyzing online user reviews in the hospitality and tourism industry. The search was restricted to English-language research papers dating from 2013 till 2022, but had no limitations regarding the source of the articles. Google scholar and other relevant scientific databases were used as a source for the articles. The main criteria were that papers deal with the topic of user review analysis in the context of hospitality and tourism industry. In total, 36 articles were taken into consideration. After the papers were collected, they were screened according to the following criteria:

1. data and sampling (specific industry, size of the sample, time period)
2. research goal (the purpose of the research)
3. methodology/technology authors used to analyze user reviews
4. data source (source or a platform that served for the data collection)

The main goal of this literature review was to find and present papers dealing with sentiment analysis in hospitality and tourism industry and to show the process of analyzing user reviews by using sentiment analysis. What is sentiment analysis, how the whole process of analyzing goes and what are the most used programs that help researchers, in hospitality and tourism, to perform SA? These are the questions that this paper addresses.

In the subsequent sections, the key findings and discussions in the work of each research stream was presented. In the second chapter process of analyzing online customer reviews was introduced along with the most popular approaches/methods for analyzing user reviews. In the third chapter literature review of 36 research papers that analyze consumer reviews in tourism and hospitality industry was presented and briefly analyzed. The fourth chapter presents most popular software solutions for conducting sentiment analysis.

2. Process of analyzing online customer reviews

Customers' data, available in the form of online reviews, have a big economic impact on a company's performance, as well as finance by ensuring optimal marketing expenditures. Owners and managers are able to use the voluminous online data to segment their markets according to the reviews of their products or services by

customers. Data and text mining techniques are especially important to reveal knowledge from online reviews, due to their importance as user-generated content.

Feature extraction is used to mine relevant evaluation attributes from the text, and sentiment analysis (SA) is used to analyze reviewers' sentiment. Although SA is often called opinion mining (OM), what OM really analyzes is people's opinion about an entity, while SA identifies the sentiment expressed in a review (Medhat et.al., 2014). Hence, SA uses textual data to get an insight into emotional tendencies towards specific attributes, and to determine whether data is positive, negative, or neutral. To perform SA, online reviews should first be scraped from websites, representing necessary data.

The first step in performing Sentiment analysis is to prepare the data. That means that irrelevant data like stop words and emoji's have to be removed and data have to be transformed into a uniform format. The second step is to extract the feature of the data, and the third step is to classify the extracted documents into certain categories (e.g. positive/negative/neutral). Machine learning and lexicon based are two common approaches. The fourth step is to present the findings in an interactive visual presentation (Liu, 2011; Ma, Cheng, & Hsiao, 2018). The process of analyzing online customer reviews is presented in Figure 1 and explained in the following subchapters.

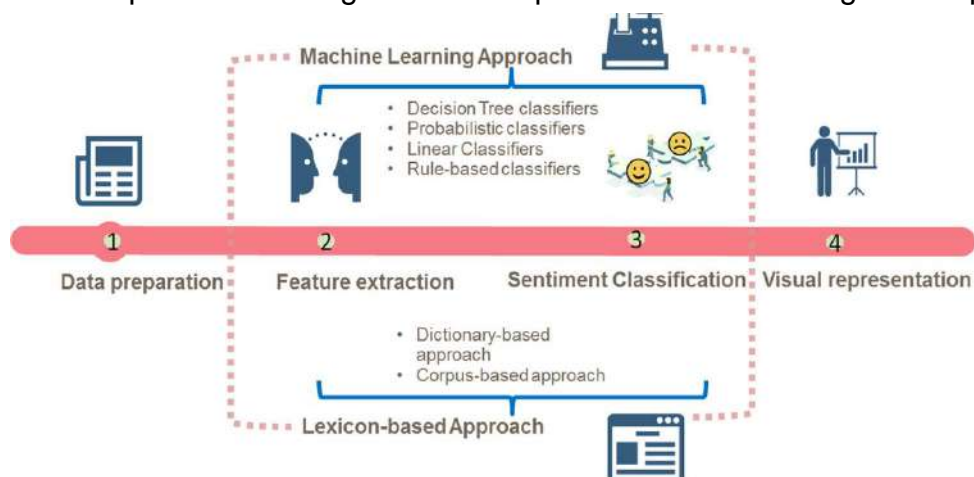


Figure 1 Process of analyzing online customer reviews
Source: Ma, Cheng, & Hsiao (2018)

2.1. Collection of data

As explained by Amadio and Procaccino (2016), accessing reviews through a user interface has limitations as those interfaces are intended for manual interpretation of one provider at a time. So, in order to identify relationships, a competitive analysis must emerge from an automated system based on text mining tools that summarize a collection of reviews stretching across multiple providers.

Most of the reviews in our literature review study were collected through some of the online social networks like Trip Adviser, from where comes the majority (46%) of all reviews in Hospitality and Tourism industry (Jain, Pamula, & Srivastava, 2021). Other social networks most popular for review collection include Booking.com, Airbnb, Facebook, Amazon, Twitter, Expedia, Yelp, and Youtube. Qunar, Ctrip, eLong, Koubei

and Ele.me are the most popular review platforms in China for hospitality and tourism industry. Some of the reviews were collected from online surveys and some of them combined reviews from social networks with online customer surveys (eg. Calheiros *et.al.*, 2017; Young, & Gavade, 2018 ...etc.).

2.2. Data analysis and preprocessing

Online reviews are usually being extracted with some kind of web scraping tool from a web source, and then analyzed using big data analytical techniques. Companies use those systems and software to make data-driven decisions for better business performance. Text mining uses collected datasets, and involves processes for building the corpus of reviews by cleaning the text from irrelevant and common words or information to improve its quality; and stemming to reduce words to a single root word (Calheiros *et.al.*, 2017). After preprocessing, one of the most popular methods used in text mining for the data is to be further transformed into a bag-of-words representation (Antonio *et.al.*, 2018). It is a text representation describing the occurrence of words within a document. Text mining is an interdisciplinary research field, which combines machine learning, statistics, computer linguistics, information retrieval and data mining. It is an automated process that reveals new knowledge, patterns and relationships from unstructured textual data (Ma, Cheng, & Hsiao, 2018).

2.3. Methods/techniques for performing Sentiment analysis (SA)

The Sentiment Classification techniques, presented by (Medhat *et.al.*, 2014), can be categorized as following:

1. *Machine learning approaches*
2. *Lexicon-based approach*

1. *Machine learning approaches*, relying on techniques such as neural networks. It appears that a combination of different ML methods would be an optimal choice in achieving relevant and reliable segmentation results across both computing and marketing contexts (Ahani *et.al.*, 2019), although Naïve Bayes and Support Vector Machines were shown as the most frequently used ML algorithms for solving SC problems (Medhat *et.al.*, 2014). There are two main machine learning algorithms approaches:

1.1. *Supervised learning techniques*, if there is a target to model (Decision tree, Linear: Support Vector Machines and Neural Network, Rule based, Probabilistic: Naive Bayes, Bayesian Network, Maximum Entropy).

1.2. *Unsupervised learning techniques*, if the goal is to find relations between instances of the problem addressed.

The supervised learning method is based on a large amount of labelled training documents, whereas the unsupervised learning method was adopted when there were difficulties in identifying labelled training.

2. *Lexicon-based approach* is based on a sentiment lexicon, which relies on pre-determined terms. It calculates the sentiment from the semantic orientation of the words and phrases in the text. Sentiment values from the dictionary are assigned to all positive and negative words or phrases within the text message. There are two

approaches and both require a predefined dictionary or corpus of subjective words. One is Dictionary based approach, the other one is Corpus based approach (Statistical and Semantic).

2.4. Delivery and visualization tools

A market segmentation analysis based upon the text mining tools and procedures is usually done through visual analytics (VA) as a combination of human abilities and machine strengths, confirming the insights obtained from data (Amadio & Procaccino, 2016). VA is automatically clustering data instances into classes based on mutual similarity, and identifying outliers in noisy data to perceive patterns and draw conclusions (Keim et.al., 2008). Cutting-edge visualization technologies are necessary for the meaningful presentation of complex results and unstructured data, transforming text data into valuable customer insights.

3. Methods and techniques for analyzing online consumer reviews in Tourism and Hospitality Industry (literature review)

Text mining and SA require considerable knowledge about natural language processing, mathematics and computer science, so this presents difficulties for hospitality researchers who have not been trained in these areas (Ma, Cheng, & Hsiao, 2018). Despite that, there are numerous papers dealing with the application of Sentiment analysis in hospitality and tourism industry, especially in the last years (2017-2022). Growing interest in Sentiment analysis is not surprising, especially in the field of hospitality and tourism, knowing that customer reviews play important part in the customers' decision making process. Our research identified 36 relevant articles in the field of hospitality and tourism industry dealing with or applying the Sentiment analysis in their research from 2013 till 2022. Most of the research papers performed sentiment analysis in the hotel industry (eg. Ahani *et.al.* 2019; Amadio, & Procaccino, 2016; Antonio *et.al.*, 2018; Antonio *et.al.*, 2018; Duan *et al.*, 2013; Hu, Chen, & Lee, 2017; Kalehbasti, Nikolenko, & Rezaei, 2019; Li, Ma, & Chao, 2020; ...etc.). Some papers analyzed sentiments towards tourist destinations (eg. Folgieri, Baldigara, & Mamula, 2018; González-Rodríguez, Martínez-Torres, & Toral, 2016), while rest of the research papers apply SA in the restaurant context, tourist agency...etc. Most of the papers used most popular tourist review social network TripAdvisor for review collection, and almost all papers had large datasets of reviews (thousand and more).

There is a tendency in hospitality and tourism research to relate SA analysis with overall online ratings, or perform further analysis with other sources of data. Amadio, & Procaccino (2016) used it as input for SWOT analysis, Antonio *et.al.* (2018) use it to predict recommendation and ratings, Au *et.al.* (2014) tried to connect complaints with the culture from which tourists come, but most of them use SA to improve their service performance (eg. Calheiros *et.al.*, 2017; Luo, Hua, & Wang, 2021; ...etc.). Kim *et al.* (2022) examined YouTube channel to uncover what factors affect attitudes towards RAISA (Robot, AI, and Service Automation) applications in the hospitality industry. The findings show that the sentiment of the content of video narration and physical interaction influence potential customer attitudes toward RAISA services in hospitality.

There is not one common approach or method they use when analyzing reviews. Some of the analyzed papers use machine learning approaches (PHP, NLP, vector regression (SVR), K-means Clustering (KMC), and neural networks (NNs); Artificial Neural Network (ANN)), and some of them use lexicon-based approaches. Most of them used custom made programs developed in Python or Java for web scraping purpose. Lots of them use R program and also free solution software like Leximancer and Stanford Core NLP. Details on methods used in each paper are presented in Table 1.

Table 1 Literature review of research papers that analyze consumer reviews in Tourism and Hospitality Industry

b.	Article	Data and sampling	Research goal	Methodology/Technology	Data source
-	Ahanti <i>et.al.</i> (2019)	spa hotels / 4930 reviews; 200 spa hotels (Google Trends for 2004–2018)	The study demonstrates how spa hotels can more effectively segment their market on the basis of traveler reviews and ratings	Text mining (PHP) was used for online reviews. The dimensionality reduction and prediction machine learning techniques were in use in developing a new and effective hybrid method (SOM, HOSVD, and CART).	TripAdvisor
-	Amaradio, & Procaccino (2016)	hotels / 3 hotels located in midtown Manhattan	The usefulness of analyzing text-based social media online reviews using text mining tools and visual analytics for SWOT Analysis.	After pre-processing in R, LDA analysis was done using the MALLET machine learning for language toolkit. Random forest classifiers were built using the R package random Forest, and feature/opinion pairs were generated by the authors' own R-implementation model.	TripAdvisor
-	Antonio <i>et.al.</i> (2018)	hotels / 23,353 reviews; 56 city and resort hotels in Portugal (January 2016 - June 2016)	The paper aims to develop a model to predict online review ratings from multiple sources, which can be used to detect fraudulent reviews and create proprietary rating indexes, or which can be used as a measure of selection in recommender systems.	The study applies The Microsoft Azure ML platform and NLP approaches, with sentiment analysis being applied based on polarity lexica. (CRISP-DM) model and customized Web scrapers (Microsoft C#) were used for data mining and R tool was used to create the data set.	Booking and TripAdvisor
-	Au <i>et.al.</i> (2014)	hotels / 822 complaints about hotels in major Chinese cities, Beijing, Guangzhou, and Shanghai (2009-2010)	The main objective of this study is to analyze online complaints about hotels in Mainland China and to examine the relationship between culture and other factors that affect the intention to complain online.	Content analyze (11 complaint categories). A two-way contingency table statistical analysis demonstrated that traveler age, hotel price, and travel partner significantly influenced the online complaints made.	TripAdvisor and Ctrip
-	Calheiros <i>et.al.</i> (2017).	eco hotel / 401 reviews; Portuguese <i>Areias do Seixo</i> eco-hotel (January & August of 2015)	Usage of online comments by hotel managers in order to improve customer experience.	Sentiment classification (lexicon-based approach) of eco-hotels manually coded customer reviews is assessed through a text mining approach. The Latent Dirichlet Allocation modeling algorithm is applied to gather relevant topics that characterize a given hospitality issue by a sentiment.	TripAdvisor Guest's book, Follow up emails, Evaluation website, Direct emails and Other.
-	Duan <i>et.al.</i> (2013)	86 hotels in the Washington D.C. area.	They obtain a extensive dataset of online user reviews for hotels across various review sites and over a long time periods.	They use the sentiment analysis technique to decompose user reviews and then incorporated results into econometrics models to examine their	TripAdvisor

		70,103 online user reviews 1999-2011		effect in shaping users' overall evaluation and content generating behavior.	
	Folgeri, Baldigara, & Mamula (2018)	Tourism destination Croatia	The results showed that including also data from sentiment analysis, the neural network model to predict tourists arrivals outperforms the previous obtained results.	Artificial Neural Network (ANN) Free sentiment analysis tools from https://www.danielsoper.com and https://www.werfamous.com . Backpropagation Artificial Neural Network using the free statistical software environment R (https://www.r-project.org/).	Two web pages for sentiment analysis https://www.croatia.hr https://www.europeanbestdestination
	González-Rodríguez, Martínez-Torres, & Toral (2016)	Comments from the consumer platform of the city of Barcelona.	Authors explore the image of travel destinations by analyzing sentiment orientation of the online reviews, and how this orientation, as well as other electronic word of mouth (eWOM)'s credibility sources, can affect the perceived helpfulness of shared opinions measured through the helpfulness score.	Authors used web scraper, while the sentiment score to analyze the discourse orientation (positive vs negative) was calculated using computer-based sentiment analysis techniques.	Consumer platform Ciao of the city of Barcelona
	Hu, Chen, & Lee (2017)	hotels / 717,002 reviews, 1158 hotels in 5 USA cities (2012-2015)	Reporting how the interactions among three user-controllable filters (geographic location, season of travel, and travel type), together with three groups of predictors, affect review helpfulness.	Stanford Core NLP was used for preprocessing. Three supervised learning techniques were used for developing prediction models (Weka 3.6.14 data-mining software), namely linear regression, reduced error-pruning tree, and random forest.	TripAdvisor
0.	Jain, Pamula, & Srivastava (2021)	Hospitality and tourism	This paper presents the study of Machine Learning techniques for consumer sentiment analysis on online reviews in the domain of hospitality and tourism.	Literature review.	Scientific databases
1.	Kalehbasti, Nikolenko, & Rezaei (2019)	Hotels and rentals/Dataset included 50,221 entries, each with 96 features	Price prediction model using machine learning, deep learning, and natural language processing techniques to aid both the property owners and the customers with price evaluation given minimal available information about the property.	Authors used a range of methods from linear regression to tree-based models, support-vector regression (SVR), K-means Clustering (KMC), and neural networks (NNs). Reviews for each listing were analyzed using TextBlob sentiment analysis library.	The public Airbnb dataset for New York City.
2.	Kim et al. (2022)	RAISA services in the hospitality context; 1032 video clips were collected from 2011 to 2020.	Authors examine YouTube to uncover what factors affect attitudes towards RAISA (Robot, AI, and Service Automation) applications in the hospitality industry. The findings show that the sentiment of the content of video narration and physical interaction influence potential customer attitudes toward RAISA services in hospitality.	They developed a data collection program based on the Google YouTube API libraries. Sentiment analysis values were generated by using two VADER and BERT.	Online video reviews -YouTube
3.	Kim, & Hyun (2021)	online travel agencies / 174,673 reviews; 4562 were posted	Exploring the impacts of review posting via Social network interface systems and Via an account, on review ratings, review age, and review length.	Regression analysis and a longitudinal time series were used. Data was collected using web analytic tool, a custom-made scraper, written in "vb.net".	TripAdvisor, Facebook

		via Facebook			
4.	Lee, & Blum (2015)	hotels / 3,495 reviews; 10 Las Vegas hotels	Investigating how hotels respond to online reviews, based on the hotel's star rating.	A comparative case study was used for this research (manual coding and content analysis).	TripAdvisor
5.	Leung <i>et.al.</i> (2013)	hotels, hospitality, travel and tourism / 44 social media-related articles	Findings and discussion in the tourism and hospitality literature on social media, published in academic journals only.	Theory development. Social Media applications metrics from the consumers' perspective and from the suppliers' perspective.	Scientific databases
6.	Li, Ma, & Chao (2020)	hotels / 4 mid-range business hotels in Beijing's Wangfujing business district	This paper proposes a method for measuring hotel customer satisfaction considering the reliability of online reviews.	Crawler tool GooSeeker was used for data collection. The method used is based on the Dempster-Shafer evidence theory. The aggregation of the evaluation information is conducted based on the entropy weight method and Dempster's rule of combination. Customer satisfaction is analyzed based on the calculated expected utility.	China's two major online travel review websites, Qunar and Ctrip
7.	Liu <i>et.al.</i> (2017)	hotels / 412,784 reviews; 10,149 hotels; 5 Chinese cities	Study used user-generated reviews to offer insights into the determinants of hotel customer satisfaction by discriminating among customers by language group.	Review's content was extracted (PHP). Language-detection was performed through the use of software, using MySQL (for Asian and Russian languages) and the textcat package, in the statistical language R (European languages). ANOVA and Tukey's HSD test were then used.	TripAdvisor
8.	Luo, Hua, & Wang (2021)	Economy hotel in Beijing and Shanghai, 363,723 Chinese-text online reviews	This paper aims to investigate the experiences of Chinese economy hotel guests by applying deep learning fine-grained sentiment analysis.	Based on the subjectivity and the linguistic characteristics of Chinese. Web crawlers in Python were used to collect data for this study.	eLong.com, one of the largest online hotel booking platform in China.
9.	Ma, Cheng, & Hsiao (2018)	Hospitality industry	The study aims to provide a critical review of the origin, development and process of sentiment analysis (SA) and a demonstration for hospitality researchers and students on how to perform SA using a sample study.	A critical review and sample case demonstration approach was applied. The sample study used Leximancer to perform SA.	TripAdvisor
10.	Mariani, & Borghi (2021)	hotels / >5.5 million online reviews for 10 hotels in America and 10 in Europe (2003–2018)	This study investigates if there is a trend in online consumers' environmental discourse and if so, whether it differs across different types of online review platforms (transaction-based vs. community-based platforms).	Web crawlers in Python were used. Descriptive statistics and parametric and non-parametric tests of (mean and median) differences were deployed due to large volumes of data	Booking and TripAdvisor
11.	Misirli, & Vlachopoulou (2018)	social media covering all industries, including tourism / 52 articles (2010 - 2016)	Research articles focusing on social media metrics and analytics in marketing.	Theory development. Categories: Methodology of research, Type of analysis, Field of study, Marketing objectives, Social media type/ platform.	Scientific databases
12.	Moro <i>et.al.</i> (2019)	hotels / 30,584 hotels;	This study highlights the convergent and divergent factors	Authors specifically developed web scraping script, Python and R, and in	TripAdvisor

		50 U.S. states (July 27 - 30, 2017)	contributing to TripAdvisor score in each of the 50 U.S. states.	modeling the TripAdvisor's score for each registered hotel using support vector machine models. This enabled knowledge extraction from the model using data-based sensitivity analysis.	
3.	Muritala <i>et.al.</i> (2020)	tourism and hospitality / 632 journal articles (2005 to 2019)	Co-citation and co-word analyses including an innovative visualization of the co-word network.	Theory development. Categories: general literature trends, foundational literature, main research themes and evolution of research interests.	Scientific databases
4.	Prameswari <i>et.al.</i> (2017)	Hotels /Bali and Labuan Bajo	This paper seeks to find useful knowledge for building the hospitality sector.	Text mining technique. Combining sentiment analysis and clustering to provide representative sentences to describe the content of reviews.	TripAdvisor
5.	Ruiz, Salto, & González (2021)	the tourism sector / total no. of tweets analysed 25,532, accounts geolocated in Málaga (2019-2020)	The words most commonly used by tourists on Twitter during the pandemic were identified, as well as the most common themes across all sentiments expressed by tourists on the social network.	A case study was used as a tool for analysing tourists' behavior and opinions. Machine learning sentiment analysis algorithms were then applied to the resulting data. R studio and the library (rtweet) package were used for extracting tweets. Data was processed using the statistical software Knime for Twitter.	Twitter
6.	Sathya, & Rajendran (2018)	68 articles, Hospitality and Tourism, 2017-2020	In this article they discuss text mining techniques like Data Mining, Information Retrieval, Information extraction, natural language processing, information visualization, clustering and etc.	Literature review.	Scientific databases
7.	Shen <i>et.al.</i> (2020)	restaurant reviews / 83,803 online reviews; 2,793 reviews per restaurant (2018) and 3,191 questionnaires (2016)	The paper analyzes multiple sources of biases embedded in online reviews, focusing on numerical ratings and potential interactions among users, technical platforms and the broader social-cultural norms.	Platform ratings were collected online with Python. Welch's t-test was used to compare average online and offline ratings across different star categories.	Dianping.com, Koubei, Meituan and Ele.me
8.	Strandberg <i>et.al.</i> (2016)	tourism and hospitality / 292 articles (2000-2014)	The article provides an overview of the evolution of the journal and presents some key trends in ongoing research within the industry.	Theory development. Categories: the nature of authorship, the most influential articles, the most influential authors, the most prolific authors, the themes covered, the manuscript characteristics of the articles.	Scientific databases
9.	Tavakoli, & Wijesinghe (2019)	tourism, travel, tourist, hotel / 7159 articles (2008 - 2018)	Netnographers have, in the main, overlooked Web 3.0, 3.5, 4.0 and 5.0, perhaps due to a lack of information technology literacy.	Theory development. Categories: disciplines, profile of netnography, type of platform used as the field of study, empirical material collection methods, data analysing techniques and framework employed in the study.	Scientific databases
10.	Xiang <i>et.al.</i> (2015)	hotels / 100 largest U.S. cities; 10,537 hotels; 60,648	Customer online reviews for hotels are analysed to deconstruct hotel guest experience and examine its association with satisfaction ratings, as well as	Sentiment analysis done through linear regression analysis. Automated Web crawler collected data and extracted customer reviews (Microsoft Access).	Expedia

		customer reviews (December 18–29, 2007)	demonstrate the usefulness of big data analytics.		
1.	Xiang <i>et.al.</i> (2017)	hotels / approx. 500 hotel properties in Manhattan;	The study examines online review platforms through text analytics, in terms of information quality related to online reviews about the entire hotel population.	Web crawlers (Python and Java) were used to collect data. Multivariate linear regression analysis examined the relationships between rating and review characteristics, including review topics and sentiment.	TripAdvisor, Expedia, and Yelp
2.	Yan, Wang, & Chau (2013)	Restaurants, 10136 reviews of 194 restaurants	The goal was to find out the antecedents of customer revisit intention to restaurants.	They used regression analysis, and manual text classification.	Koubei website, online life communities in China
3.	Young, & Gavade (2018)	Tourism / 986 usable surveys from the employees of one US tourist resort	They used sentiment analysis to improve the understanding of a large data set of employee comments from an annual employee job satisfaction survey of a US hospitality organization.	Sentiment analysis and R software.	Surveys
4.	Yang <i>et.al.</i> (2018)	hotels / 25 articles (2009 - 2017)	Relationship between electronic word of mouth and hotel performance.	Theory development. Categories: authors, publication source, performance measure, eWOM valence measure, eWOM volume measure, data structure, number of elasticities obtained.	Scientific databases
5.	Zhao <i>et.al.</i> (2021)	hotels / 2,468,306 ratings and reviews; 4 hotels	Compares online ratings from multiple websites for 4 hotels according to features and expressed sentiment.	Feature extraction and sentiment analysis were based on Leximancer and Stanford CoreNLP separately; and then the Overall and Individual Review PLTS were achieved according to users' emotional tendencies	TripAdvisor, Ctrip and Hostelworld websites for case studies
6.	Zinko <i>et.al.</i> (2020)	hotels, cruise ships, fast food / (2284 participants)	The study examined the effects (positive, neutral, negative) that reviews with images have on consumer outcomes associated with eWOM.	A scenario web-based simulation experiment done with the responses from subjects, collected via Amazon's Mechanical Turk (MTurk)	Amazon

Source: authors

4. Tools/software for sentiment analysis

Most tools for performing sentiment analysis have two main components: the processing components and the dictionaries. The processing components contain programs which analyze text files. The dictionaries contain a collection of words defining particular categories, including emotion categories. Emotion word categories are often formed by multiple human judges (Tausczik and Pennebaker, 2010). These are the four most popular programming tools to perform sentiment analysis in hospitality and tourism industry. More details and pros and cons on each program can be found in paper by Ma, Cheng, & Hsiao, 2018.

Stanford Core natural language processing and Apache Open natural language processing can identify the feeling, opinion or belief contained in a statement, ranging

from very negative, to neutral, to very positive. Apache Open NLP is available in multiple languages such as English, Spanish, Chinese, French and German.

Leximancer. Leximancer is a high-level natural language processing software that quantifies texts based on Bayesian theory, Leximancer contains a lexicon plus a machine learning hybrid method called the Sentiment and it can support 18 languages including Croatian, Dutch, Danish, English, Greek, German, Finnish, Spanish, French, Indonesian, Italian, Malay, Polish, Russian, Portuguese, Serbian, Turkish and Swedish.

Linguistic inquiry and word count. LIWC is a proprietary database consisting of many categorized regular expressions. The program was developed in the early 1990s. It can be used to analyze texts and reveal the thoughts, feelings, personality and motivations contained in them.

Wordnet and SentiWordNet. Wordnet is a free tool program developed by Princeton University available to the public (Wordnet, 2010).

When it comes to scraping tools for obtaining reviews from different sources, there are two possible ways to take. One is to build a custom solution in some popular programming language like Python, or choosing from one of many available final products. The custom solution requires good programming foundations but allows it to be tailored exactly for your use case, and can be easily changed along the way if such a requirement emerges. The downside of the custom solution is that it cannot be utilized without prior programming knowledge. It requires some time to be invested in building the solution before scraping can start. It might have high maintenance costs, especially if targeted web pages change a lot.

The final product on the other hand usually doesn't require programming foundations, it is easy to use, and allows the process of scraping to be immediate. The downside of the final product is that they are usually freeware, meaning there is some trial period after which you must pay for the product and that amount can be high in some cases. They also don't support all use cases, so if your requirements change you may have to switch to another product.

5. Conclusion

Sentiment analysis has a big potential for future development. Although it is even now used successfully, its application is limited mostly for academic use. The main reason is the complexity of the process and the necessary mathematical knowledge, knowledge of algorithms and programming languages, which makes SA difficult to apply if you don't have that knowledge or you don't have a programmer in your team. In the future, the process itself should be simplified and made accessible and easily applicable to both businesses and consumers.

Also there are some other problems regarding SA that have to be addressed and one of them is performing text analysis across multiple languages which is a difficult and time consuming task. Every language has a different degree of expressive power, culture-conditioned responses and other peculiarities which has to be considered. Aggregating reviews from different sources to include as much reviews from various travel sites can also be challenging task and require programming skills.

SA could be very useful and efficient in identifying positive and negative trends that are emerging in hotels, tourist destinations, restaurants and react proactively to those

trends. Also, lots of researchers use SA to predict satisfaction ratings, recommendations, prices...etc. Future research can investigate the relationship between SA and sales revenues, profits, image...etc. SA can also be performed among competing restaurants and hotels helping business operations identify their competitive strength and weakness. There are many potential applications of SA in the future especially in tourism and hospitality industry, but also in many other industries.

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MEASURING DESTINATION PERFORMANCE: EFFICIENCY PERSPECTIVE OF CROATIAN DESTINATIONS

Goran Ćorluka

University of Split, University Department of Professional Studies, Split, Croatia
gcorluka@oss.unist.hr

Vanja Vitezić

University of Rijeka, Faculty of Tourism and Hospitality Management, Rijeka, Croatia
vanjav@fthm.hr

Matea Visković

University of Split, University Department of Professional Studies, Split, Croatia
mviskovic@oss.unist.hr

Abstract. Tourism is experiencing a rapid grow over the last decade. This economic activity has been positioned in many countries as one of the main development pillars. Tourism destinations put the focus on the increase of quantitative performance indicators, at the same time qualitative performance indicators have been failed to look after. A general perspective is that tourism was, in most destinations, growing but not developing. Tourism activities began to take on a negative character, as negative tourism implications outweighed positive tourism implications. Tourism destinations have to become more efficient in destination resource utilization, targeting the strategy less is more opposite to the most common applied strategy more is more. The purpose of this paper is to conduct a destination performance analysis and to provide tourism destination policy makers accurate information for future strategic decision making. The objective is achieved by the application of the Data Envelopment Analysis (DEA) in the efficiency performance evaluation of Croatian destinations. The destination efficiency is evaluated on a county level by taking into consideration destination inputs, number of accommodation and arrivals, and outputs, overnights. Secondary data provided by the Ministry of Tourism is used. In the context of Croatia, such an analysis takes on additional significance due to the extreme spatial and temporal concentration of tourism activities in the country. The research results show an overall efficiency of the 21 Croatian counties observed of 67.1%, a technical efficiency of 82.9% and a scale efficiency of 81.9%. There are significant differences between the Croatian counties in all calculated efficiency values. However, the Croatian counties operate at an acceptable level of efficiency, achieve high effectiveness with the given inputs, and have a reasonable ratio between the size of the operation and the maximum output.

Key words: *tourism destination, destination efficiency, Data Envelopment Analysis, Croatia*

1. Introduction

The tourism industry is characterised over the last decade by expansion and dispersion of tourism activities. Despite occasional shocks the tourism sector proved its strength and resilience. 2019 was the tenth consecutive year of sustained growth, performing 1,460 million international tourist arrivals and 1,481 billion USD (UNWTO, 2021). Perceived as a strategic orientation of social and economic progress in developing countries (Joshi et al., 2017), tourism has gained in importance, simultaneously an increasing number of countries have turned to tourism as a priority determinant of economic growth. By entering the tourism market destinations target the strategy more.

Destinations focal point is the incensement of quantitative indicators of destination performance, without critically consideration of their causal relationship, at the same time qualitative indicators are neglected. Uncontrolled growth of tourism activities results in negative economic, ecological and sociocultural implications. At the same time overtourism has become an integral part of the tourism industry and many destinations worldwide face consequences (Peeters et al., 2018).

In order to maximize the positive impacts and to minimize negative aspects of tourism, the need to adopt appropriate growth strategies is highlighted (Pestana et al., 2011). A significant aspect of sustainable tourism development is that tourism destinations have to be more efficient. Tourism destinations have to develop strategies to target the approach less is more. The strategic goal would be to achieve greater performance with a high quality product and with fewer tourists, but better quality tourists. Better resource utilization and efficient input output relation is needed. Such tourism approach would contribute to local life quality, lower cultural impact, better nature preservation, better visitor experience, change of customer perception, spreading the tourist season and to more revenues. A necessary prerequisite for tourism development management is the evaluation of tourism activities and destination performance (Botti et al., 2009). Performance measurement is an important managerial activity and a crucial support in destination management and business decision making. Tourism policy makers require accurate destination performance analysis and resulting indicators as input data for future strategic decision-making.

The aim of this paper is to evaluate efficiency performance of Croatian destinations. Croatia is an example of the Mediterranean phenomenon of seasonality affected beach tourism destinations attributed to the exclusive or dominant orientation to the leisure beach tourism product. Croatia is experiencing a spatial and temporal concentration of tourism activities. Seven coastal counties out of the total twenty-one counties have a share of 94,1% in accommodation offer, 86,5% in tourist arrivals and 94,6% in tourist overnight stays. The high season period ranging from June to September generates 90,2% of total tourist arrivals and 84,04% total tourist overnights (Ministry of Tourism, 2019). Extreme seasonality in align with the appearance of overtourism due to extensive and uncontrolled growth of tourism activities emphasize the need for destination efficiency evaluation. This study conducts a destination performance analysis and provides reliable information to tourism destination policymakers for future strategic decisions through the implementation of Data Envelopment Analysis (DEA) in the efficiency performance evaluation of Croatian destinations. On a county level, destination efficiency is assessed by taking into account destination inputs that include accommodation and arrivals, as well as destination outputs, in this case overnight stays. Tourist arrivals result in overnight stays, and while these two appear to be similar, it's important to distinguish them since overnights better reflect the impact of tourism on the economy than other indicators do. A large number of arrivals in a destination does not necessarily imply a large number of overnight stays, which might be a sign of destination inefficiency. By considering a more holistic approach with targeting the much needed strategy of less is more as opposed to the most common applied strategy of uncontrolled growth, this analysis holds additional importance considering Croatia's extreme spatial and temporal concentration of tourism activities.

2. Literature review

In the tourism literature the analysis of destination efficiency is relatively new. Despite the importance and need for evaluation of destination performance, destination efficiency analysis has been disregarded by researchers. Efficiency in the tourism literature has primarily concentrated on quantifying the level of efficiency at micro-units, most often concerning the hotel industry, with few studies examining its determinants, while largely ignoring the interdependent nature of tourism. Research that has contributed to hotel efficiency findings are e.g. Huang et al., 2006, Min et al., 2008, Tumer, 2010, Manasakis et al., 2013, Parte-Esteban and Alberca-Oliver, 2015, Oukil and Al-Zidi, 2018, Sellers-Rubio, Casado-Díaz and Casado-Díaz, 2018, Pulina and Santoni, 2018. Kozak (2002) was one of the first to coin the term “destination performance” by comparing Spain and Turkey. Performance indicators are widely acknowledged as a vital instrument for destination development and management. These indicators may be defined as sets of information used to measure changes in specific aspects of tourism destinations and operations. Key performance indicators (KPI) are intended to enable comparisons on performance and target setting typically used to improve productivity. Current literature includes a number of studies that rely on production frontiers analysis to assess destination efficiency in terms of their ability to utilize their inputs to produce the greatest possible output. Two of the most used methods include data envelopment analysis (DEA) and stochastic frontier analysis (SFA) as methodologies which rely on production frontier analysis and are mostly used for comparing the technical efficiency of decision-making units (DMUs). Botti et.al., (2009) examined the tourism efficiency of twenty-two regions in France using the Data Envelopment Analysis. Number of hotels, parks, camps, monuments, museums and miles of available beaches were inputs, while the output variable was the number of tourists. Technical efficiency was achieved in 10 regions, which can serve as examples of good practice and benchmarks for increasing efficiency in the remaining regions. Cracolici et.al., (2007) applied the DEA method in order to evaluate the efficiency of different Italian regions. They applied two different methods to the 103 Italian regions during 2001., using one output and three inputs. National and international bed nights were used as the output, while cultural heritage sites, number of employees in tourism industry, number of beds in hotels and complementary accommodations and population of tourism school graduates in their working age where used as inputs. The results drawn included that local DMOs should work hard if they were to improve the performance of Italian destinations while focusing and giving attention to the balance of inputs and outputs. Bosetti et al. (2006) evaluated the performance of twenty Italian regions. They mainly used DEA to evaluate efficiency during 2003. but also calculated the total factor productivity with MPI from during the period 2001.-2003. Number of tourists, homogeneity of tourism flow and percentage of protected area were used as outputs, while the inputs included market size, public expenditure (environmental production, tourism management and advertising) and tourism development index. Barros et al. (2011) evaluated the efficiency of twenty-two French regions using a two-stage DEA method during the period 2003.-2007. In the first stage, accommodation capacities and number of tourist arrivals where used as input while the number of overnight stays was the output. The second phase included variables representing tourist attractions (museums, monuments, parks, beaches, ski resorts and natural parks). They concluded that the most important factors affecting efficiency are the sea

exit and the cleanliness of the coast. For locations that do not fit these criteria, the planned development strategy should include increasing the number of theme parks, monuments, ski resorts, and nature parks. The authors suggest that increasing the number of tourist attractions and expanding the tourist offer improves the efficiency of tourist regions which are least developed.

3. Methodology and data

In this paper the Data Envelopment Analysis (DEA) approach is applied to the evaluation of twenty-one Croatian counties. Data Envelopment Analysis is a non-parametric method that measures efficiency by solving the separate linear programming problem (LPP) for each productive unit. Given a set of inputs and outputs associated with decision-making units (DMUs) DEA constructs an efficient production frontier with the observations that achieve an optimal combination of variables (Wadud & White, 2000). Non-parametric deterministic methods such as DEA do not request assumptions about the shape of the production function and the distribution of error terms. Essentially, these methods form what is known as the technology theorem, which describes the largest possible increase in output such that the resulting input-output combination remains feasible (Pevcin, 2014). The originally defined DEA (see Charnes et al., 1978)) takes into consideration only proportional increases in inputs and outputs, i.e. it operates under the assumption of constant returns to scale (CRS). To overcome this rigidity and replicate more realistic situations, Banker et al. (1984) reformulated the model with variable returns to scale (VRS) and endowed it with greater flexibility to adapt to the specific characteristics of each situation (Wadud & White, 2000). Based on this first approach, it is possible to either maximize outputs with the available resources or minimize inputs given the outputs of each DMU.

Tourism is one of the major sectors of the Croatian economy. After the Great Recession, businesses in the manufacturing sector declined compared to prospering tourism sector (Vitezić et al., 2018). According to the Tourism Satellite Account (TSA) of the Croatian Statistical Office, the economic output of tourism in 2016 was 11.4% of Croatia's GDP, while the total contribution of tourism to the Croatian economy reached 16.9% in the same year. However, Croatia as a tourist destination is highly seasonal, with summer holidays, beaches, and beach tourism being the most dominant tourism form (Ćorluka et al., 2021). In the last decade, tourist overnight stays in continental and Adriatic Croatia show a markedly uneven distribution, indicating the positive economic development of the Adriatic part of Croatia (Srhoj et al., 2021). The seasonal and spatial concentration of tourism activities raises the question of the efficiency of resource use.

This study attempts to develop an approach to measure the performance of destinations (counties) and compare them with other destinations. Secondary data from the Ministry of Tourism is used. Following the approach of Pestana et al. (2010), a destination can be seen as a business with inputs and outputs, where the goal of a destination management organisation (DMO) is to reach maximum efficiency through the proper use of its inputs. The efficiency of a destination is assessed at the county level by looking at the inputs of the destination, the number of accommodations and arrivals, as two commonly used input variables in present research, and the output, the overnight stays, as an indicator of efficiency. Tourist arrivals generate overnight stays, and although these two concepts seem similar, it is interesting to separate them

because the number of overnight stays better characterizes the economic return of tourism. A large number of arrivals in a destination does not always result in a large number of overnight stays, which can be an indicator of an inefficient destination (Pestana et al., 2010). Table 1 shows input (accommodation and arrivals) and output (overnight stays) variables representing the tourist activities of 21 Croatian counties.

Table 1 Input and output variables (21 Croatian Counties)

		Inputs		Output
		Accommodation (No of beds)	Arrivals (in 000)	Overnights (in 000)
1	Zagrebačka	12,486	140	225
2	Krapinsko-zagorska	2,991	178	387
3	Sisačko-moslavačka	1,051	38	95
4	Karlovačka	14,334	364	626
5	Varaždinska	3,324	81	184
6	Koprivničko-križevačka	827	19	35
7	Bjelovarsko-bilogorska	894	24	77
8	Primorsko-goranska	190,064	2,966	15,315
9	Ličko-senjska	40,827	821	2,856
10	Virovitičko-podravska	712	17	45
11	Požeško-slavonska	894	20	41
12	Brodsko-posavska	1,001	37	60
13	Zadarska	142,678	1,752	9,869
14	Osječko-baranjska	2,958	108	218
15	Šibensko-kninska	81,619	1,009	5,549
16	Vukovarsko-srijemska	1,603	80	134
17	Splitsko-dalmatinska	230,816	3,657	17,966
18	Istarska	290,879	4,482	26,389
19	Dubrovačko-neretvanska	82,463	2,237	8,334
20	Međimurska	1,583	82	197
21	Grad Zagreb	22,016	1,454	2,639
	Mean	53,620	932	4,345
	Median	3,324	140	225
	Min	712	17	35
	Max	290,879	4,482	26,389
	Std. dev.	86,603.75	1,344.04	7,317.10

As shown in Table 1, Croatian counties have an average accommodation capacity of 53,620 beds. However, from the standard deviation, it can be seen that the number of accommodation units is highly dispersed across the counties (Std. dev. = 86,604). On the other hand, the counties have an average of 932,000 tourist arrivals generating 4,345,000 overnight stays. Following the accommodation issue, a high standard deviation for the second input variable (arrivals; Std. dev. = 1,344.000) and the output variable (overnight stays; Std. dev. = 7,317.000) shows that the data is dispersed over

a wider range of values, suggesting that the mean may not be representative of the data set. Evidently, the amount of inputs, that is, the number of beds and tourist arrivals, is not evenly distributed across the 21 Croatian counties, indicating the possibility that county DMOs may not be equally efficient in managing tourism resources.

4. Research results and discussion

To analyze the efficiency of county DMOs, DEAP program version 2.1 developed by Coelli (1996) is used.

Table 2: DEA technical efficiency scores for Croatian Counties (2019)

No	County	CRS	VRS	SCALE	RS
1	Zagrebačka	0.148	0.174	0.850	IRS
2	Krapinsko-zagorska	1.000	1.000	1.000	-
3	Sisačko-moslavačka	0.712	0.950	0.750	IRS
4	Karlovačka	0.363	0.383	0.948	IRS
5	Varaždinska	0.454	0.555	0.817	IRS
6	Koprivničko-križevačka	0.328	0.875	0.375	IRS
7	Bjelovarsko-bilogorska	0.721	1.000	0.721	IRS
8	Primorsko-goranska	0.849	0.867	0.979	DRS
9	Ličko-senjska	0.605	0.605	1.000	-
10	Virovitičko-podravska	0.505	1.000	0.505	IRS
11	Požeško-slavonska	0.384	0.875	0.439	IRS
12	Brodsko-posavska	0.500	1.000	0.500	IRS
13	Zadarska	0.638	0.710	0.899	DRS
14	Osječko-baranjska	0.585	0.661	0.885	IRS
15	Šibensko-kninska	0.770	0.771	0.999	IRS
16	Vukovarsko-srijemska	0.695	0.986	0.705	IRS
17	Splitsko-dalmatinska	1.000	1.000	1.000	-
18	Istarska	0.999	1.000	0.999	DRS
19	Dubrovačko-neretvanska	0.843	1.000	0.843	DRS
20	Međimurska	0.984	1.000	0.984	IRS
21	Grad Zagreb	1.000	1.000	1.000	-
	Mean	0.671	0.829	0.819	
	Median	0.695	0.950	0.885	
	St. dev.	0.254	0.235	0.206	

Note: CRS = overall efficiency from CRS DEA; VRS = technical efficiency from VRS DEA; SCALE = scale efficiency = CRS/ VRS; RS = returns to scale (Increasing returns to scale (IRS); Decreasing returns to scale (DRS))

Table 2 shows the results of the multi-stage DEA estimation of efficiency values for the Croatian counties. The efficiency scores range from 0 (least efficient = 0%) to 1 (most efficient = 100%) and define a ranking of the 21 Croatian counties. The constant return to scale DEA-CRS score represents the overall efficiency of each unit, destination, assuming full proportionality between the inputs and outputs, while the variable return

to scale DEA-VRS score represents the pure technical efficiency of each unit, destination, without assuming this proportionality of inputs and outputs, and is based on axioms of convexity. The scale efficiency (SCALE) corresponds to the quotient of CRS score and VRS score, representing the optimality of the size of operation.

As can be seen from Table 2, the estimated average efficiency score under CRS of Croatian counties is 0.671, 67.1% efficiency, meaning that on average destinations could improve their overall efficiency by 32.9%. If we look at the technical efficiency score under VRS, it is 0.829, 82.9% efficiency, meaning that on average destinations could improve their technical efficiency by 17.1%. The gap in the CRS and VRS score indicates the ability of DMOs to achieve the largest output with the current level of input in given circumstances, in this case attain overnights by available accommodation and arrivals, but at the same time the disproportion in size of operation. The average scale efficiency score under SCALE is 0.819, 81.9% efficiency, meaning that, in the observed Croatian counties, on average the gap between overall efficiency and pure technical efficiency is 18.1%. Croatian counties operate at an acceptable level of efficiency, achieving effectiveness with given inputs and having justifiable relation of size of business operation and the business maximum output. Additionally, significant differences in all calculated efficiency scores are prevalent among Croatian counties.

According to the CRS score, there are three efficient counties with regard to the overall efficiency (100 per cent), namely Krapinsko-zagorska, Splitsko-dalmatinska and Grad Zagreb. With the assumption of full proportionality between the inputs and outputs these destinations achieve maximum efficiency. Eight counties are technically efficient according to the VRS score, namely Krapinsko-zagorska, Bjelovarsko-bilogorska, Virovitičko-podravska, Brodsko-posavska, Splitsko-dalmatinska, Istarska, Dubrovačko-neretvanska, Međimurska County and Grad Zagreb. Basing on axioms of convexity of inputs these destinations achieve maximum output efficiency. Counties with a score of less than 100% are relatively inefficient. For example, Zadarska County with a CRS score of 0.638 is only 63.8% as efficient as the best performing counties. In terms of scale efficiency (SCALE), four counties stand out: Krapinsko-zagorska, Ličko-senjska, Splitsko-dalmatinska County, and Grad Zagreb. These destinations have optimality of the size of operation without gaping between overall and technical efficiency in input usage. The measure of returns to scale (RS) shows 13 counties with increasing returns to scale (IRS) and four counties with decreasing returns to scale (DRS). According to Pestana et al.'s (2011) explanation, increasing returns to scale (IRS) exist when an increase in a unit's inputs leads to a disproportionate increase in its outputs. Decreasing returns to scale (DRS) are present when a reduction in a unit's inputs leads to a disproportionately small reduction in its outputs. Returns to scale can be interpreted to mean that it is worthwhile to increase inputs if the regions have a IRS. In the case of DRS, on the other hand, a reduction in input values is necessary. In other words, tourism regions that have DRS are oversized and can therefore achieve efficiency gains by reducing inputs.

5. Conclusion

Croatia as a tourist destination with the dominant summer leisure destination product is highly seasonal effected. The seasonal and spatial concentration of tourism activities raises the question of the efficiency of resource use. This specificity of Croatia as a tourist destination is an additional contribution to the research. The aim of this paper

was to conduct an analysis of destination performance and provide accurate information for future strategic decisions to decision makers in the tourism industry. The objective is achieved by applying Data Envelopment Analysis (DEA) in evaluating the efficiency of Croatian destinations. Destination efficiency is assessed at the county level, taking into account inputs (number of accommodations and arrivals) and outputs (overnight stays). This study contributes to the existing literature by adding interesting empirical findings to the sparse theoretical knowledge and managers' awareness of destination efficiency. The research findings highlight the importance of destination performance measurement and provide new empirical insights. To our knowledge, no recent study has directly measured and compared the performance levels of these regions. Moreover, by applying an innovative methodology that has not been applied to Croatian regions before, this work contributes to the existing literature on the tourism industry.

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THE COMPLIANCE WITH THE SUSTAINABLE DEVELOPMENT GOALS IN THE VALENCIAN SOCIAL ECONOMY: AN EXPLORATORY STUDY

Navarro Moros, María José
Florida Universit aria, Spain
mnavarro@florida-uni.es

Broz Lofiego, Adri an
Florida Universit aria, Spain
abroz@florida-uni.es

Abstract. The Sustainable Development Goals (SDGs) approved in 2015 and reflected in the 2030 Agenda, have meant a turning point in existing public initiatives of a social and environmental nature. Whether at the level of the European Union, the Spanish State, its autonomous communities or even in the case of numerous city councils, it is common to explicitly link the relationship between different initiatives and their potential contribution to achieving the SDGs. Companies have turned out to be a key factor in promoting more sustainable development and in managing social and environmental impacts. The world of cooperative organisations has not been exempted from the opportunities and obligations that meeting the SDGs brings. In this context, Florida Universit aria, a founding member of the *Laboratorio de los ODS de la Empresa Valenciana* conduct a qualitative study related to Valencian social economy enterprises in order to determine: (i) the degree of knowledge of the SDGs and the level of depth about what they are and what they mean, (ii) which SDGs are most aligned with productive activity and how enterprises can contribute to their fulfilment, (iii) what are the main obstacles encountered by Valencian social economy enterprises in the implementation of the SDGs and (iv) which SDGs most enterprises comply with and which ones they do not. Results show that SDGs are part of the DNA of Valencian cooperatives, and they are working very hard to increase the level of fulfilment of these objectives, although it is a complex process, full of challenges.

Key words: *Sustainable Development Goals, Valencian Social Enterprises, Social and Environmental Initiatives, Cooperatives.*

1. Introduction

The Sustainable Development Goals (SDGs) approved in 2015 and reflected in the 2030 Agenda, have meant a turning point in existing public initiatives of a social and environmental nature. The aim of this initiative was to achieve a peaceful and more prosperous future, eradicating at the same time poverty, reducing consumerism, achieving equality, ensuring a fairer society and an equitable education, among others; the main challenge of the SDGs is to accomplish sustainable economic growth, full and productive employment, and decent work for every person in the world, in developed and emerging countries (Cermelli & Tr apaga, 2021).

Whether at the level of the European Union, the Spanish State, its autonomous communities or even in the case of numerous city councils, it is common to explicitly link the relationship between different initiatives and their potential contribution to achieving the SDGs. Companies have turned out to be a key factor in promoting more

sustainable development and in managing social and environmental impacts. Business concern about the SDGs stems from the demand of an increasingly aware society, as well as from the search for new opportunities to develop the competitive advantage (Laboratorio ODS Empresas, 2022).

The world of cooperative organisations has not been exempted from the opportunities and obligations that meeting the SDGs brings. In fact, many social economy enterprises claim that the SDGs are part of the DNA of their organisations. Although cooperatives often do not communicate well what they are doing and how, in many aspects they can be considered pioneers in this type of initiatives (López-Rodríguez, 2019; Alarcón Conde & Álvarez Rodríguez, 2020; López Rodríguez, 2021).

Based on the attributes of the nature of the social economy movement, “cooperative organizations, through their social actors, guided by collective principles of solidarity, reciprocity and sharing, assume a prominent role in the promotion of the SDGs, linked to a proposal for social welfare, social justice, quality of life and cultural transformations around the world, becoming determinants in the process of awareness, transformation and cultural change of individuals so that they can rethink the action and the role played in the world” (Hocayen-da-Silva & Hocayen-da-Silva, 2021, page 83). For this reason, investigating the commitment of Valencian social economy organisations to sustainability has become a very interesting research topic in the business and cooperative sphere.

The aim of this paper is to present the results of an exploratory study related to Valencian social economy enterprises in which we have sought to determine: (i) the degree of knowledge of the SDGs and the level of depth about what they are and what they mean, (ii) which SDGs are most aligned with productive activity and how enterprises can contribute to their fulfilment, (iii) what are the main obstacles encountered by Valencian social economy enterprises in the implementation of the SDGs and (iv) which SDGs most enterprises comply with and which ones they do not.

Based on the research and its results, the hypothesis that Valencian social economy enterprises verify a high level of compliance with the Sustainable Development Goals will be tested, as it is in their *raison d'être* and that it is often more a problem of lack of communication of what has been done than a lack of compliance.

This paper is organized as follows: the literature review at section 2 introduces relationship between SDGs and Social Economy Enterprises. Section 3 shows the results of a focus group held in some social economy enterprises of the Valencian Community by Florida Universitària, a founding member of the *Laboratorio de los ODS de la Empresa Valenciana*. Finally, in section 4 we include some arguments that reflect the importance of the topic, we present the main conclusions, we discuss the limitations of the study and suggest future lines of research.

2. The Relationship between SDGs and Social Economy Enterprises

In 2015, the United Nations proposed a new SDG agenda, based on 17 goals, 169 targets and 232 indicators, aimed at ending poverty (economic sustainability), protecting the planet (environmental sustainability), and ensuring prosperity for all (social sustainability) (United Nations, 2015). The SDGs cover a wide range of issues including poverty, hunger, health and well-being, education, gender equality, water and

sanitation, energy, growth and employment, industry and innovation, inequalities, sustainable cities, responsible consumption and production, climate action, oceans and underwater life, biodiversity and terrestrial life, peace and inclusiveness, and global governance (Figure 1).



Figure 1 The Global Goals of Sustainable Development

The SDGs recognize that each country has the primary responsibility for its own economic and social development and encourage member states to formulate, as soon as possible, national responses for its implementation. It has also been established as an important condition for the implementation of the 2030 Agenda the incorporation of the Sustainable Development Goals (SDGs) in the actions of all the constituent parts of a government by adopting a joint approach, while the various institutions of government coordinate and implement integrated policies (United Nations, 2018).

Cerdá (2020) considers that “the conditions facing the achievement of the SDGs are very different and depend on the circumstances of each country, and even within countries, the conditions can be very varied and sometimes insurmountable, so the degree of difficulty of this task takes on features in each region. Nevertheless, if there is commitment and political will on the part of the actors involved, the goal or the greatest progress can be achieved.” (pp. 153).

The new way of understanding and exercising business management that the Sustainable Development Goals represent, has aroused the interest of different organisations and institutions at local, national, European Union and international level. These, little by little, have begun to issue different pronouncements, communications and documents that have become the reference framework for understanding the SDGs and why sustainability must be promoted in companies. All the above has led to a growing concern, from a global point of view, about the role and impacts or externalities that companies cause in their social and environmental context and how

these translate into contributions to the achievement of the SDGs at a regional or national level (Laboratorio ODS Empresas, 2022). Dziubaniuk et al. (2021) argue, there is a huge challenge in SDG management, which includes a great complexity regarding the interaction in international stakeholder networks in the context of projects focused on the implementation of the Sustainable Development Goals (SDGs).

Sustainable business can contribute to the achievement of the 2030 Sustainable Development Goals and can address economic, environmental, and social challenges such as hunger and poverty eradication through job creation, technological innovation and the provision of financial resources and knowledge. Moreover, responsible business brings a new approach to accelerate the implementation of the SDGs (Laboratorio ODS Empresas, 2022).

Similarly, the Social and Solidarity Economy (SSE), in which cooperatives organizations are included, is consolidating itself as a reference in the debates on the construction of other ways of understanding the economy and other ways of doing business. Faced with the logic of capital and its accumulation, the SSE seeks to build relations of production, distribution, consumption, and financing based on justice, cooperation, reciprocity, and mutual aid. It is about placing people and their work at the centre of the economic system, giving markets an instrumental role at the service of the well-being of all people and the extended reproduction of life on the planet (Villalba-Eguiluz et al., 2020)

The Cooperative Principles, as the guiding threads of cooperative management, stipulate the need to carry out actions for the benefit of the community, to train members, to cooperate among cooperatives and to promote actions for the preservation of the environment, among others. This leads to linking the practices of cooperatives as contributions to the SDGs. Alarcón-Conde & Álvarez Rodríguez (2020) mention that in the case of Colombia, there is evidence that cooperatives contribute to the fulfilment of the SDGs through the promotion of their principles. Findings emphasise that principles such as concern for the community and education, training and information are more closely related to the achievement of SDG targets, and therefore practices that are carried out in line with these principles will tend to generate more cross-cutting contributions. But this does not undermine the importance of the other Cooperative Principles as they are part of an organisational ecosystem of multiple actors; cooperative identity is a central element in directing the contributions of cooperatives to the 2030 Agenda agreements.

Considering that cooperatives have become a transformative element within society and that they stand out for having a very important part of the sustainable development goals incorporated within their principles, assessing how Valencian cooperatives are acting in a sustainable manner and in line with the SDGs has become an interesting topic of study. As a response to this need, in the next section we comment the main results of a qualitative study carried out among social enterprises in the Valencian Community under the framework of the *Laboratorio de los ODS de la Empresa*

Valenciana, a public initiative developed by the General Direction of Economy, Entrepreneurship and Cooperativism of the Comunitat Valenciana.

3. Focus group analysis of implementation and experience in sustainable development objectives: a qualitative study.

The aim of this section is to comment the results of a qualitative analysis regarding the awareness, the depth of knowledge, the compliance, and the inhibitors to the implementation of SDGs in the Valencian social economy organizations. The information obtained could be used in the future to complement and/or supplement a wider qualitative and quantitative research on this topic.

The approach method has used the focus group (FG) methodology. The use of the focus group technique or FG as a group interview method, as opposed to the extraction of knowledge individually, can help participants to express themselves freely and openly on the topic of discussion, in this case, on the degree of knowledge and application of the SDGs in their business management models. In addition, the synergistic effect of the group can help produce data or ideas that do not emerge in a one-on-one interview. It is in this environment where the use of the FG, from our point of view, from the qualitative perspective, contributes to the definition of a franker approach to the object of analysis (Laboratorio ODS Empresas, 2022).

On Tuesday 6th July 2021, Florida Universitària, a founding member of the *Laboratorio de los ODS de la Empresa Valenciana*, organized the Focus Group on Social Economy Organisations (FGSEO). After intense reflection to ensure that the focus included the point of view of the different types of organisations that make up the social economy (in terms of sectors and size), a list of twelve organisations was built, six of which made up the final sample, an optimal number for this type of research (Kuhn, 2018).

Participants represent four sectors in which social economy organizations are involved deeply like education (Grupo Sorolla), large-scale distribution (CONSUM), banking (Caixa Popular) and services [Fundación Novaterra (a non-governmental organisation focused on the socio-occupational integration of people), COVALSER (a cooperative dedicated to the integral commercialisation of office products and didactic material), and SERCOVAL (a cooperative provider of personal, social and community services)].

The questionnaires were designed to cover the knowledge of the participating companies about this sustainable development agenda in a gradual and in-depth manner up to the level of the 17 SDGs. In the FGSEO, the following aspects were addressed:

1. How many companies are aware of the SDGs and what is the level of depth of their knowledge of what they are and what they mean?
2. Which SDGs are most aligned with the productive activity of companies and how do they consider that they can contribute to their achievement?
3. What are the main obstacles encountered by companies in the Valencia Region in the implementation of the SDGs?
4. Which are the SDGs that most companies in the Valencian Region comply/do not comply with?
5. In what way or with what type of actions are companies in the Valencia Region fully or partially complying with the SDGs?

The following groups of questions were generated for this purpose:

I. Knowledge of SDGs by the business community of the Valencian Community:

- a. Does the business structure of the Valencian Community know what the SDGs are, how to implement them, are they a fashion to position themselves or part of the strategy?
- b. How does the cooperative sector view the SDGs? Is it a fad? Is it a commitment to society?
- c. Do organizations measure the impact and contributions of fulfilling SDGs?

Main conclusions in these aspects comprise:

- All participating companies acknowledge that they are aware of the SDGs, although there are differences in their approach to how to implement them within the organisation.
- The largest institutions or those with a track record in this area (Novaterra, Grupo Sorolla, Caixa Popular and Consum) have already incorporated them into their strategic plan or have been working on them within the framework of corporate social responsibility.
- Those that are already working on them have placed great emphasis on measuring and setting Key Performance Indicators (KPIs) and showing the results to society. Consum suggests the standardisation of indicators in the framework of the Balanced Scorecard.
- It is not possible to address all SDGs and targets at the same time, it is necessary to prioritise. It is proposed to prioritise and then implement phases. Grupo Sorolla recommends the use of the Global Compact tool.
- Some cooperatives, the smaller ones (Sercoval and Covalcer), maintain that they are green, but they have addressed only few objectives within the quality system. They recognise that they need to get fully involved now, although they have no idea how to go about it.
- One of the participants doubts that the stakeholders (customers, partners, and management) are fully aware of the SDGs.
- The role of education and internal and external communication in organisations is emphasised.
- Participants talk about mainstreaming, both in terms of areas and people in the organisation, as well as the value chain and other stakeholders.
- One of the participants doubts that the business sector all over the world, including themselves, can fulfil objectives in time.
- The SDGs are in the DNA of cooperatives and their principles (decent work, care for the environment and training). Values promoted (helping with poverty, the environment, diversity, integration, and sustainability) are those that this type of organisation has been working on since its origins. Seeking a fairer and more egalitarian society, which is what the SDGs aim to achieve, is something that cooperatives have been working on since the very beginning of the movement.
- It is not a passing fad. It is expected that after 2030, new goals and targets will be defined will respect the 5Ps (planet, relationships, people, peace, and prosperity), regardless of the number of goals and targets that will be defined in the future. Society demands now and will continue demanding in the future, the accomplishment with the 5Ps intrinsically and extrinsically.

- If cooperatives were not committed to society, they would not be cooperatives, they would be other types of organisations. Moreover, it is argued that cooperatives have been promoting inter-cooperation (another way of calling alliances) since the mid-19th century.

II. Obstacles to implementation:

a. *What obstacles does the company face when implementing the SDGs in the strategy? Legislation, aid, time...*

Participants are asked to mention which obstacles have been overcome or are still to be overcome.

- Some participants said they had no idea how to implement the SDGs. It is difficult to frame the specific action with the SDG and its targets.
- Definitions of goals and targets are theoretical and difficult to frame.
- One participant suggests doing it the other way around: first look at the goals and targets and understand them and then see how the organisation can contribute to the fulfilment of them.
- The importance of will and determination is mentioned. *"If there is will, there are no obstacles. The obstacle appears when everyone sets their own limits"*.
- It is necessary to move forward slowly and steadily. It is not possible to contribute to all the SDGs. One of the participants said that out of the 17, they have worked on 8/9. Progress is being made on some with the hope and determination to make further progress on the others.

III. Company actions:

a. *What is each company doing to mainstream the SDGs?*

b. *How is the contribution of the SDGs measured?*

- Theoretical goals and targets need to be translated into concrete actions.
- Internal accountability should be emphasized and implemented within the organisation.
- It is necessary to measure, with normalised / standardised indicators, although there are times when measurement is very difficult, and the definition of indicators is not so simple.

IV. SDG communication:

a. *How are the SDGs being communicated by your companies?*

- Cooperatives have years of advantage over other types of organisations regarding the SDG goals and targets. It is questioned that perhaps they have not been as effective in communicating and highlighting their contribution and behaviour promoting the accomplishment of these goals. Other organisations sometimes have better marketing. One participant argues that, as the SDGs are in the DNA of cooperatives, they are taken for granted, as if they were not important.
- The SDGs are a compass, a framework for action, which enables organisations to order what they were doing and plan what they intend to do in the future.
- Cooperatives need to value what they do. The communication strategy needs to be rethought.

V. Compliance/prospects:

a. Will the goals be achieved by 2030?

Participants were asked about which of the SDGs are more related to the cooperative activity. Main answers were:

- **Sorolla Group:** SDGs 1, 3, 4, 5, 8, 10, 12 and 16.
- **Caixa Popular:** they take those SDGs related to the social, the environmental and the economic footprint (3,4,5,8,9,10,11,12,13 and 17)
- **Fundación Novaterra:** SDGs 8 (the most important), 10 and 17.
- **CONSUM.** SDG2 (end hunger and overhaul the food system to make it sustainable in terms of health and environmental sustainability), 5 (promote gender equality), 7 (energy), 8 (quality work), 12 (plastics management, shelf-life, waste, and food waste).
- **SERCOVAL:** SDGs 5, 8,10 and 11.
- **COVALSER.** SDGs 5 and 10 that talk about equality. They also mention diversity which is embodied in several SDGs.

Considering the answers of total participants, the most important SDGs related to the cooperative activity are: SDG5 (Gender Equality), SDG8 (Good Jobs and Economic Growth) and SDG10 (Reduced Inequalities) as it can be observed in Figure 2.



Figure 2 Most Relevant SDGs among Valencian Cooperatives

Finally, participants were asked about what actions had been carried out in each organization to incorporate de SDGs into their business strategy? Additionally, we asked how contributions can be measured?

Main results were:

- The resilience of cooperatives and their impact on inclusion and sustainability is emphasized. It is all about corporativism: people come before interests and return on capital. The person is at the centre, which changes the picture... it's a 360° view. A differential element of corporativism.

- The values represented by the SDGs are a source of competitive advantage. However, there are times when decisions have a negative impact on the bottom line in the short term. This is where participants postulate consistency between what is said and done, on the basis that in the medium and long term, there can be a positive impact on sales and profits.
- Cooperatives need to value what they do. The communication strategy needs to be rethought.
- Responsibility and profitability must go hand in hand (economic aspects go hand in hand with social and environmental aspects). Sometimes it is difficult to measure in the short, medium, or long term the return on the sustainability actions that are carried out... all of this is often related to the intangibility of the actions carried out and their impacts.

Once all questions had been answered, participants were asked if they had any additional comments. Finally, they were thanked for their participation and links were established for the development of future relationships/collaborations.

4. Conclusions

In this section we want to summarize the main conclusions that arise from the qualitative study we did among Valencian cooperatives, including the implications and limitations of this work. Additionally, we propose some future lines of research.

The main conclusions we obtained can be summarized as follows:

- It is difficult for cooperatives to align their strategy with actions aimed at implementing the SDGs. Additionally, is very difficult for cooperatives to work coherently on the 17 SDGs all together.
- Limited training of managers and employees on the SDGs. Bidirectional implementation should be reinforced, driven by management, but with the active participation of the different areas and stakeholders.
- It is necessary to provide information and training to different stakeholders, a guide to good practices and success stories, as well as valid indicators for measuring the SDGs.
- All participating companies acknowledge that they are aware of the SDGs.
- Those that are already working on them have placed great emphasis on measuring and setting Key Performance Indicators.
- It is not possible to address all SDGs and targets at the same time. It is necessary to move forward slowly and steadily.
- The role of education and internal and external communication in organisations is emphasised.
- The SDGs are in the DNA of cooperatives and their principles.
- Definitions of goals and targets are theoretical and difficult to frame.
- The importance of will and determination is mentioned.
- Theoretical goals and targets need to be translated into concrete actions.
- The resilience of cooperatives and their impact on inclusion and sustainability is emphasized.
- The values represented by the SDGs are a source of competitive advantage.
- Responsibility and profitability must go hand in hand.

- xv. Valencian cooperatives, in general, have positive attitude towards the SDGs, independently of the sector in which they are and the dimension they have.
- xvi. The qualitative study shows that for the Valencian cooperatives, the most relevant objectives, and the ones on which they have worked most are the following: SDG5 (Gender Equality), SDG8 (Good Jobs and Economic Growth) and SDG10 (Reduced Inequalities)
- xvii. The support of the Public Administration is needed, as well as obtaining the relevant certifications of the implementation.
- xviii. One of the main conclusions to be highlighted is related to the values of the cooperative movement: the culture of the cooperative movement is very aware of many of the SDGs, and even small cooperatives that do not have their own implementation of the SDGs in their organisational culture are implementing them without calling them with that name.

We are clear about the limitations of the work carried out: it focuses only on a few cooperatives in some specific sectors (services, bank, large scale distribution and education) in the Valencian Community. It would also be necessary to continue complementing this qualitative research with others that include more sectors and greater geographical diversity, which could then be complemented with quantitative research that would allow to draw stronger conclusions. The situation of cooperatives should also be compared with other types of organisations in the capitalist world. Finally, the situation between cooperatives and capitalist enterprises of different sizes could also be compared to analyse similarities and differences.

Finally, as a conclusion of the qualitative study carried out, and taking into consideration the limitations of this study, the hypothesis that Valencian social economy enterprises verify a high level of compliance with the Sustainable Development Goals could be preliminarily accepted.

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**CIET
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SCIENTIFIC PAPERS

CONTRIBUTION TO BENDING WITH SHEAR INFLUENCE OF THIN-WALLED LAMINATED COMPOSITE I-BEAMS WITH MONO-SYMMETRIC CROSS-SECTION AND VARIABLE ELASTIC PROPERTIES

Marko Vukasović

Faculty of Electrical Engineering, Mechanical Engineering and Naval Architecture, Split,
Croatia

Marko.Vukasovic@fesb.hr

Radoslav Pavazza

Faculty of Electrical Engineering, Mechanical Engineering and Naval Architecture, Split,
Croatia

Radoslav.Pavazza@fesb.hr

Miljenko Vuko

Faculty of Electrical Engineering, Mechanical Engineering and Naval Architecture, Split,
Croatia

Miljenko.Vuko@fesb.hr

Abstract. Analytic approach to bending with shear influence of thin-walled laminated composite I-beams with mono-symmetric cross-section is presented. Beams composed of balanced laminates with symmetric lay-up and with variable elastic properties over the cross-section area are considered. Closed-form analytic solutions for the stresses and displacements are provided according to general analytic model developed for the thin-walled laminated composite beams with arbitrary open cross-sections and constant elastic properties. For the analyzed types of beams it is shown that in order to obtain uncoupled differential expressions the new center of gravity needs to be found, i.e. the new principal axes and coordinates. It is also proved that the position of the new center of gravity depends on elastic properties of laminates in beam cross-section, as well as on geometric properties. New shear factors are defined with respect to geometry of the cross-section and also with respect to variable elastic properties of laminates. Several examples of the simply supported I-beams subjected to bending with uniformly distributed load acting in the plane of symmetry have been analyzed. Beams with low length-to-height aspect ratios are taken into analysis. The influence of fiber orientation on the displacements of the center of gravity and on distribution of the displacements and stresses has been examined. The results obtained by presented analytic approach are compared with the finite element solutions. Excellent agreement of the results is obtained.

Key words: *Bending; Shear; Thin-walled composite beams; Variable elastic properties; Analytic solutions.*

1. Introduction

Thin-walled beams made of fiber-reinforced plastics have been extensively used in a variety of structures due to number of advantages, as high strength-to-weight and stiffness-to weight ratios. Also, opportunity to be tailored according to design requirements of stiffness and strength makes them convenient for various structural applications [1, 2]. In the process of analysis, well-known expressions for geometric

properties used in classical beam theories, such as cross-section area, first moment of area, second moment of area, center of gravity, shear center, etc., cannot be used for thin-walled composite beams due to variability of material properties over the cross-section. For that reason, new mechanical properties which include both geometric and material characteristics had to be defined [3-7].

In the process of exploitation thin-walled composite beams can be subjected to bending and torsion types of loading, which is why the stress and displacement analysis is important part of the design process. Different analytic solutions with shear influence included have been presented over the past two decades for the static analysis of thin-walled laminated composite beams subjected to bending and torsion [8-13]. Furthermore, diverse formulations of finite beam elements for the displacement analysis have also been presented [14-16]. In these papers the researchers are mostly focused on derivations of adequate stiffness matrix and on performing convergence study of adequate beam elements.

Analytic approach to bending with shear influence of thin-walled laminated beams with mono-symmetric cross-sections will be presented in this work. Beams assembled of balanced laminates with symmetric lay-up and with variable elastic properties over the cross-section area will be taken into consideration. Analytic solutions for the stresses and displacements will be obtained by following general analytic model developed for thin-walled laminated composite beams with arbitrary open sections and constant elastic properties over the cross-section area [13], i.e. by following derivations presented for bending analysis with shear influence of thin-walled beams made of isotropic material [17-19]. The influence of material properties, i.e. the fiber orientation, on the displacements of the center of gravity will be investigated for different stacking sequences. The distribution of the normal stresses with the fiber angle in characteristic cross-section point will be presented with respect to different elastic properties in the same point. Furthermore, the displacement analysis will also be performed with respect to fiber orientations. All the results will be validated by comparison with the finite element method (FEM), utilizing shell elements.

2. Strains and displacements

The longitudinal displacement of an arbitrary point $S(x, s)$ of the cross-section middle line $u_s = u_s(x, s)$, for bending with shear influence, for beams with z -axis of symmetry (Figure 1), can be expressed as [17-19]

$$u_s = u_M - \frac{dw}{dx} z + \int_0^s \gamma_{x\xi} ds = u_M + \beta z + \int_0^s \gamma_{x\xi} ds, \quad \beta = -dw/dx, \quad (1)$$

where $w = w(x)$ is the displacement in the z -direction, i.e. the displacement of the cross-section middle line as a rigid line in the plane of symmetry; $z = z(s)$ is the rectangular coordinate, $u_M = u_M(x)$ is the longitudinal displacement of the starting point M of the curvilinear coordinate s , actually, the displacement of the cross-section middle line as a rigid line in the x -direction; $\gamma_{x\xi} = \gamma_{x\xi}(x, s)$ is the shear strain in the beam middle surface where ξ is the tangential axis on the curvilinear coordinate s ; $Oxyz$ is

the orthogonal coordinate system, where the z-axis is the axis of symmetry; $\beta = \beta(x)$ is the angular displacement of the middle line as a rigid line with respect to the y-axis, orthogonal to z-axis.

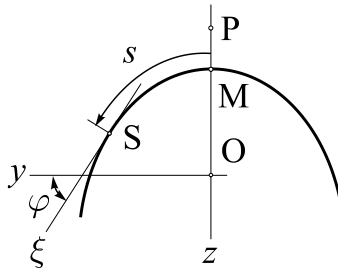


Figure 1 Portion of the cross-section middle line.

The displacements can also be written as

$$w = w_b + w_a, \quad u_M = u_a, \quad (2)$$

where $w_b = w_b(x)$ is the displacement of the cross-sections as a plane sections in the z-direction, as by the ordinary theory of bending, $w_a = w_a(x)$ is the additional displacement due to shear in the z-direction, $u_a = u_a(x)$ is the additional displacement due to shear in the x-direction. The angular displacements can be expressed as

$$\beta = \beta_b + \beta_a, \quad \beta_b = -dw_b/dx, \quad \beta_a = -dw_a/dx. \quad (3)$$

Thus, the strain in the longitudinal direction can be expressed as

$$\varepsilon_x = \frac{\partial u_S}{\partial x} = \frac{du_M}{dx} - \frac{d^2w}{dx^2}z + \int_0^s \frac{\partial \gamma_{x\xi}}{\partial x} ds. \quad (4)$$

3. Stresses in terms of dipalcements

The plane force –strain relations, in the $x - \xi$ coordinate system, can be written as [2]

$$\begin{Bmatrix} N_x \\ N_\xi \\ N_{x\xi} \end{Bmatrix} = \begin{bmatrix} A_{11} & A_{12} & 0 \\ A_{12} & A_{22} & 0 \\ 0 & 0 & A_{66} \end{bmatrix} \begin{Bmatrix} \varepsilon_x \\ \varepsilon_\xi \\ \gamma_{x\xi} \end{Bmatrix}, \quad (5)$$

where $N_x = N_x(x, s)$, $N_\xi = N_\xi(x, s)$ and $N_{x\xi} = N_{x\xi}(x, s)$ are the normal and shear forces per unit length. Elements of the extensional stiffness matrix $[A]$ are defined as

$$A_{ij} = \sum_{k=1}^N (\bar{Q}_{ij})_k (\eta_k - \eta_{k-1}), \quad (6)$$

where N is the total number of plies in laminate, η_k and η_{k-1} are the distances from the middle surface to the two surfaces of the k -th ply, and $(\bar{Q}_{ij})_k$ are the elements of the stiffness matrix $[\bar{Q}]$ of the k -th ply. Modified laminate stiffness coefficients a_{ij} can be introduced as [13]

$$A_{ij} = t \sum_{k=1}^N (\bar{Q}_{ij})_k \left(\frac{\eta_k}{t} - \frac{\eta_{k-1}}{t} \right) = ta_{ij}, \quad (7)$$

where t is the cross-section thickness, i.e. the laminate thickness. According to Eqs. (5) and (7), the constitutive relations can also be written in terms of average normal and shear stresses as

$$\begin{Bmatrix} \bar{\sigma}_x \\ \bar{\sigma}_\xi \\ \bar{\tau}_{x\xi} \end{Bmatrix} = \begin{bmatrix} a_{11} & a_{12} & 0 \\ a_{12} & a_{22} & 0 \\ 0 & 0 & a_{66} \end{bmatrix} \begin{Bmatrix} \varepsilon_x \\ \varepsilon_\xi \\ \gamma_{x\xi} \end{Bmatrix}, \quad (8)$$

where $\bar{\sigma}_x = N_x/t$ and $\bar{\sigma}_\xi = N_\xi/t$ are average normal stresses in x and ξ directions and $\bar{\tau}_{x\xi} = N_{x\xi}/t$ is the average shear stress. The normal stress in the cross-section contour direction ξ is small compared to the normal stress in the longitudinal direction and may be neglected in the constitutive relations given by Eq. (8) as [13]

$$\begin{Bmatrix} \bar{\sigma}_x \\ \bar{\tau}_{x\xi} \end{Bmatrix} = \begin{bmatrix} a_{11}^* & 0 \\ 0 & a_{66}^* \end{bmatrix} \begin{Bmatrix} \varepsilon_x \\ \gamma_{x\xi} \end{Bmatrix}, \quad (9)$$

where the elements of the reduced extensional stiffness matrix are: $a_{11}^* = a_{11} - \frac{a_{12}^2}{a_{22}}$,

$$a_{66}^* = a_{66}.$$

According to Eqs. (4) and (9), normal stress in longitudinal direction can now be written in terms of displacements as

$$\bar{\sigma}_x = a_{11}^* \left(\frac{du_M}{dx} - z \frac{d^2w}{dx^2} \right) + a_{11}^* \int_0^s \frac{1}{a_{66}^*} \frac{\partial \bar{\tau}_{x\xi}}{\partial x} ds. \quad (10)$$

The expression for the average shear stress $\bar{\tau}_{x\xi}$ can be found from the equilibrium of a differential portion of the wall in the longitudinal direction as

$$\bar{\tau}_{x\xi} = \frac{1}{t} \left[- \int_0^s \frac{\partial (\bar{\sigma}_x t)}{\partial x} ds + T_M \right], \quad T_M(x) = \bar{\tau}_{x\xi}(x, M) \cdot t(M), \quad (11)$$

where after the substitution of Eq.(10), and under the assumption

$$\partial \bar{\tau}_{x\xi} / \partial x = \text{const.},$$

it follows

$$\bar{\tau}_{x\xi} = \frac{1}{t} \left(-A^c(s) \frac{d^2u_M}{dx^2} + S_y^c(s) \frac{d^3w}{dx^3} \right) + \frac{1}{t} T_M, \quad (12)$$

where $S_y^c(s) = \int_0^s a_{11}^* z dA$, $A^c(s) = \int_0^s a_{11}^* dA$, $dA = t ds$. Eq. (12) can also be written as

$$\bar{\tau}_{x\xi} = \frac{1}{t} \left(A^* \frac{d^2u_M}{dx^2} - S_y^* \frac{d^3w}{dx^3} \right), \quad (13)$$

where $S_y^{c*} = \int_{s^*} a_{11}^* z dA^*$, $A^{c*} = \int_{s^*} a_{11}^* dA^*$, $dA^* = t ds^*$, $ds^* = -ds$. $S_y^{c*} = S_y^{c*}(s)$ is the moment of the cut-off portion of cross-section area with respect to the y axis; $A^{c*} = A^{c*}(s)$ is the cut-off portion of cross-section area; s^* is the curvilinear coordinate of the cut-off portion of the beam wall area, from the edge, i.e. where $\bar{\tau}_{x\xi} = 0$.

4. Equilibrium equations

For a portion of the beam wall the following equilibrium equations can be written [17-19]

$$\sum F_x = \int_L \frac{\partial(\bar{\sigma}_x t)}{\partial x} dx ds = 0, \quad \sum F_z = \int_L \frac{\partial(\bar{\tau}_{x\xi} t)}{\partial x} \sin \varphi dx ds + q_z dx = 0, \quad (14)$$

where $q_z = q_z(x)$ are the forces per unit length, acting in the plane of symmetry. Eq. (14), after integration by parts, can be written as

$$\int_A \frac{\partial \bar{\sigma}_x}{\partial x} dA = 0, \quad \int_L z \frac{\partial}{\partial s} \left[\frac{\partial(\bar{\tau}_{x\xi} t)}{\partial x} \right] ds - q_z = 0. \quad (15)$$

By substituting Eqs. (10) and (12) in Eq.(15), the following expressions are obtained

$$A^c \frac{d^2 u_M}{dx^2} - S_y^c \frac{d^3 w}{dx^3} = 0, \quad -S_y^c \frac{d^3 u_M}{dx^3} + I_y^c \frac{d^4 w}{dx^4} = q_z, \quad (16)$$

where the material-geometric characteristics of the beam cross-section are

$$A^c = \int_A a_{11}^* dA, \quad S_y^c = \int_A a_{11}^* z dA, \quad I_y^c = \int_A a_{11}^* z^2 dA. \quad (17)$$

If the principal rectangular coordinate z is defined according to classic mechanics, then S_y^c will be zero only when a_{11}^* is constant over the whole cross-section area. In order to obtain uncoupled differential expressions in Eq. (16), for arbitrary stacking sequences of laminates, the new principal coordinate can be found as

$$S_y^c = \int_A a_{11}^* z dA = \int_A a_{11}^* (z^c + \Delta z^c) dA = 0, \quad (18)$$

where z^c is the principal coordinate obtained according to classic mechanics and Δz^c is the constant (displacement of the center of gravity), introduced to satisfy the Eq. (18). It follows from the Eq. (18)

$$\Delta z^c = - \frac{\int_A a_{11}^* z^c dA}{A^c}. \quad (19)$$

Now, according to Eqs. (18) and (19), the uncoupled equilibrium equations can be written

$$A^c \frac{d^2 u_M}{dx^2} = 0, \quad I_y^c \frac{d^4 w}{dx^4} = q_z. \quad (20)$$

5. Internal forces and stresses

Integration of the shear stress component $\bar{\tau}_{x\xi}$ over the cross-section area gives [17-19]

$$Q_z = \int_A \bar{\tau}_{x\xi} \sin \varphi dA, \quad (21)$$

where $Q_z = Q_z(x)$ is the shear force with respect to the z-axis. Substitution of Eq. (13) into Eq. (21), after integrating by part, gives

$$Q_z = -I_y^c \frac{d^3 w}{dx^3}, \quad \int_A S_y^{c*} dz = \int_A a_{11}^* z^2 dA = I_y^c. \quad (22)$$

Referring to Eqs. (20) and (24), one has

$$dQ_z/dx = -q_z. \quad (23)$$

Thus, by substituting Eqs. (20) and (22) into Eq. (13), the shear stress in terms of internal force can be written as

$$\bar{\tau}_{x\xi} = \frac{Q_z S_y^{c*}}{I_y^c t}. \quad (24)$$

Integration of the normal stress component $\bar{\sigma}_x$ over the cross-section area gives

$$N = \int_A \bar{\sigma}_x dA = 0, \quad M_y = \int_A \bar{\sigma}_x z dA, \quad (25)$$

where $N = N(x)$ is the normal force and $M_y = M_y(x)$ is the bending moment with respect to the y-axis. Substitution of Eq. (10) into Eq. (25), and with respect to Eqs. (23) and (24) one has

$$A^c \frac{du_M}{dx} - N^z = 0, \quad M_y = -I_y^c \frac{d^2 w}{dx^2} - M_y^z, \quad (26)$$

where the secondary (due to shear) normal force $N^z = N^z(x)$ and secondary bending moment $M_y = M_y(x)$ are defined as

$$N^z = \frac{q_z}{I_y^c} \int_A a_{11}^* dA \int_0^s \frac{S_y^{c*}}{a_{66}^* t} ds = \frac{q_z}{I_y^c} \int_L \frac{A^{c*} S_y^{c*}}{a_{66}^* t} ds, \quad (27)$$

and

$$M_y^z = \frac{q_z}{I_y^c} \int_A a_{11}^* z dA \int_0^s \frac{S_y^{c*}}{a_{66}^* t} ds = \frac{q_z}{I_y^c} \int_A \frac{1}{a_{66}^*} \left(\frac{S_y^{c*}}{t} \right)^2 dA. \quad (28)$$

Referring to Eqs. (20), (22) and (26), the following relations can be written

$$\begin{aligned} \frac{d^2 u_M}{dx^2} = \frac{dN^z}{dx} = 0, \quad -I_y^c \frac{d^3 w}{dx^3} = \frac{dM_y}{dx} + \frac{dM_y^z}{dx} = Q_z, \\ -I_y^c \frac{d^4 w}{dx^4} = \frac{d^2 M_y}{dx^2} = \frac{dQ_z}{dx} = -q_z. \end{aligned} \quad (29)$$

The secondary components (due to shear) can also be written as

$$N^z = q_z \kappa_{xz} L, \quad \kappa_{xz} = \frac{1}{I_y^c L} \int_L \frac{A^{c*} S_y^{c*}}{a_{66}^* t} ds, \quad (30)$$

and

$$M_y^z = q_z \frac{\kappa_{zz} I_y^c}{A^c}, \quad \kappa_{zz} = \frac{A^c}{(I_y^c)^2} \int_A \frac{1}{a_{66}^*} \left(\frac{S_y^{c*}}{t} \right)^2 dA, \quad (31)$$

where κ_{xz} and κ_{zz} are the shear factors with respect to the u and w -displacements. The shear factors are defined with respect to the elastic properties of laminates in the cross-sections and with respect to the geometric characteristics.

Hence, the normal stress given by Eq. (10), with respect to Eqs. (23), (24), (26), (30) and (31) can finally be written as

$$\bar{\sigma}_x = a_{11}^* \frac{M_y}{I_y^c} z + a_{11}^* q_z \frac{\kappa_{zz}}{A^c} z + a_{11}^* q_z \frac{\kappa_{xz} L}{A^c} - \frac{q_z}{I_y^c} a_{11}^* \int_0^s \frac{S_y^{c*}}{a_{66}^* t} ds. \quad (32)$$

6. Differential equations with separated displacements

Eq. (26), according to Eqs. (30) and (31), can be expressed as

$$\frac{du_M}{dx} = \frac{q_z \kappa_{xz} L}{A^c}, \quad \frac{d^2 w}{dx^2} = -\frac{M_y}{I_y^c} - \frac{q_z \kappa_{zz}}{A^c}. \quad (33)$$

Referring to Eq. (2), it can be written

$$\frac{du_a}{dx} = \frac{q_z \kappa_{xz} L}{A^c}, \quad \frac{d^2 w_b}{dx^2} = -\frac{M_y}{I_y^c}, \quad \frac{d^2 w_a}{dx^2} = -\frac{q_z \kappa_{zz}}{A^c}. \quad (34)$$

Integrating the first and third expression of Eq. (34), taking into account Eqs. (3) and (23), the following relations can be obtained

$$u_a = -Q_z \frac{\kappa_{xz} L}{A^c}, \quad \frac{dw_a}{dx} = -\beta_a = Q_z \frac{\kappa_{zz}}{A^c}, \quad (35)$$

where the integration constants are ignored in Eq. (35). It is assumed that the additional longitudinal displacement u_a , as well as the additional angular displacement β_a , do not depend on the boundary conditions [17-19]. Second expression of Eq. (34) is analogous to the well known equation of the elementary theory of bending, i.e. I_y^c is analogue to flexural rigidity EI_y , where E is Young's modulus of elasticity and I_y second moment of area with respect to the y axis. Analogously, the following relations can also be written

$$I_y^c \frac{d^3 w_b}{dx^3} = -\frac{dM_y}{dx} = -Q_z, \quad I_y^c \frac{d^4 w_b}{dx^4} = -\frac{d^2 M_y}{dx^2} = -\frac{dQ_z}{dx} = q_z. \quad (36)$$

Integration of the second expression of Eq. (35) gives

$$w_a = M_y \frac{\kappa_{zz}}{A^c} + C_w, \quad (37)$$

where C_w is the integration constant with respect to the w -displacement.

7. Boundary conditions

According to Eq. (37), boundary conditions at the starting point A ($x = 0$) can be defined as

$$w_a = 0, \quad C_w = -M_{yA} \frac{\kappa_{zz}}{A^c}, \quad (38)$$

where M_{yA} is the bending moment at the left end $x = 0$. Total displacements can now be presented as

$$w = w_b + (M_y - M_{yA}) \frac{\kappa_{zz}}{A^c}, \quad u_a = -Q_z \frac{\kappa_{xz} L}{A^c}. \quad (39)$$

The boundary conditions for simply supported beams, for hinged end sections A and B, can be written as

$$w|_{x=X_{A,B}} = w_b|_{x=X_{A,B}} = 0, \quad \frac{d^2 w}{dx^2} \Big|_{x=X_{A,B}} = \frac{d^2 w_b}{dx^2} \Big|_{x=X_{A,B}} = 0 \quad (M_{yA,B} = 0). \quad (40)$$

8. Mono-symmetric I-section

The normal stress at the junction of the web and top flange (point B in Figure 2), according to Eq. (32), can be expressed as

$$\bar{\sigma}_x = -a_{11}^* \frac{M_y}{I_y^c} h_{1C} \cdot \Phi_B, \quad (41)$$

where for uniformly distributed forces per unit length, for the mid-span of the simply supported beam the shear correction factor Φ_B with respect to normal stress can be written as

$$\Phi_B = 1 + 8 \frac{\kappa_{zz} I_y^c}{A^c I^2} \left[1 - \frac{A^c (3a_{11, top\ flange}^* A_1 + a_{11, web}^* t_0 h_{1C}) h_{1C}}{3a_{66, web}^* \kappa_{zz} I_y^c t_0} - \frac{\kappa_{xz} L}{\kappa_{zz} h_{1C}} \right], \quad (42)$$

where $A_1 = b_1 \cdot t_1$ and l is the beam length.

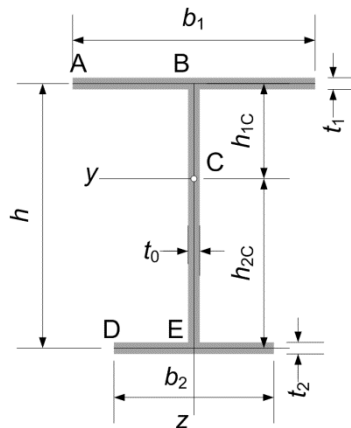


Figure 2 Mono-symmetric I-section.

The total w -displacement, according to Eq. (39), can be written as

$$w = \eta_w w_b, \quad w_b = \frac{5q_z l^4}{384I_y^c}, \quad (43)$$

where for uniformly distributed forces per unit length, for the mid-span of the simply supported beam, the shear correction factor with respect to w -displacements can be written as

$$\eta_w = 1 + \frac{48}{5} \frac{\kappa_{zz} I_y^c}{A^c l^2}. \quad (44)$$

9. Illustrative examples

Presented analytical model is used in the stress and displacement analysis of thin-walled laminated composite I-beams with mono-symmetric cross-sections. Beams assembled of balanced laminates with symmetric lay-up and with different elastic properties over the cross-section are considered. The analytically obtained results are validated by comparison with the finite element method (FEM). 3D FEM models are obtained by using ADINA software [20] and four-noded composite shell elements are employed in numerical analysis. The cross-section geometric properties are as follows (Figure 2): the width of top and bottom flange is $b_1 = 4$ cm and $b_2 = 3$ cm, the cross-section height is $h = 5$ cm, the thicknesses of top and bottom flanges are $t_1 = 0.312$ cm and $t_2 = 0.208$ cm, and thickness of the web is $t_0 = 0.104$ cm. All the computations were carried out for the glass-epoxy composite material with the following elastic properties

$$\begin{aligned} E_1 &= 53.78 \text{ GPa}, & E_2 = E_3 &= 17.93 \text{ GPa}, \\ G_{12} = G_{13} &= 8.96 \text{ GPa}, & G_{23} &= 3.45 \text{ GPa}, \\ \nu_{12} = \nu_{13} &= 0.25, & \nu_{23} &= 0.34, \end{aligned} \quad (45)$$

where the subscripts "1" and "2" correspond to the directions parallel and perpendicular to the fibers. The detailed stacking sequences of the laminates in cross-sections are given in Table 1, where α_f is the angle between the fiber direction and the x-axis.

Table 1 Stacking sequences of mono-symmetric I-beams

Stacking sequence	top flange	bottom flange	web
CASE 1	$[+\alpha_f/-\alpha_f]_{6s}$	$[+\alpha_f/-\alpha_f]_{4s}$	$[0/45/90/-45]_s$
CASE 2	$[0/45/90/-45]_{3s}$	$[0/45/90/-45]_{2s}$	$[+\alpha_f/-\alpha_f]_{2s}$

The displacement of the center of gravity with respect to fiber angle in top and bottom flange (CASE 1) and in web (CASE 2) is presented in Figure 3 according to Eq. (19)

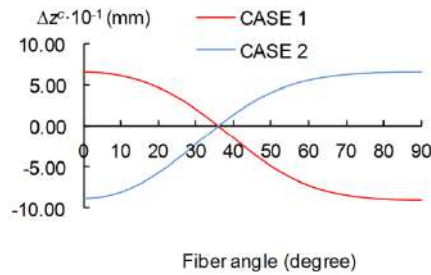


Figure 3. Displacement of the center of gravity with respect to the fiber angle

The displacements of the center of gravity are changing signs near 35° degrees, which indicate that there is an orientation of fibers for which the elastic properties of laminates in cross-section will become constant.

The variation of the normal stresses in the junction of the web and top flange (point B in Figure 2), with respect to the fiber angle and different elastic properties of web and top flange, is presented in Figures 4 and 5 for two different stacking sequences according to Eq. (42). The results refer to simply-supported beams with $l/h = 3$ aspect ratio, subjected to uniformly distributed load $q_z = 1 \text{ N/mm}$ in the plane of symmetry.

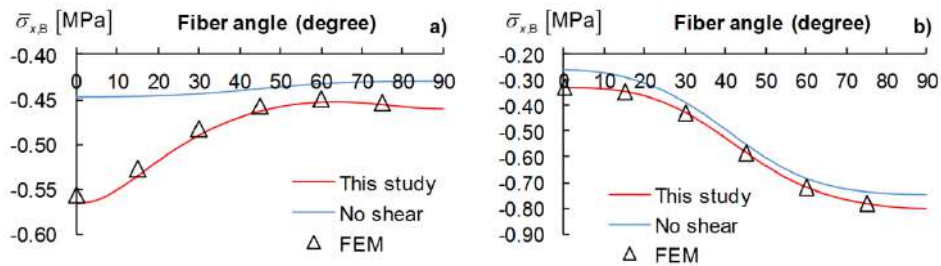


Figure 4. Variation of the normal stresses in the junction of the web and top flange for CASE 1: a) top flange; b) web.

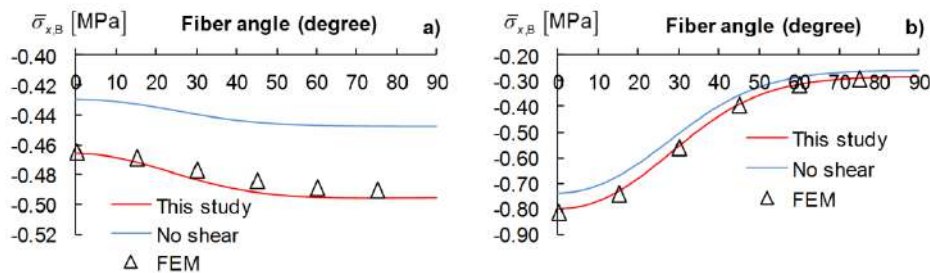


Figure 5. Variation of the normal stresses in the junction of the web and top flange for CASE 2: a) top flange; b) web.

As expected, the different values of the normal stresses in point B, due to the different modified laminate stiffness coefficients a_{11}^* , are obtained from the distribution on the top flange and web for the CASE 1. The absolute values in point B on top flange are reducing with the fiber angle, while on the other hand the absolute values at the same

point on the web are increasing with the fiber angle. The opposite situation is found for the CASE 2 where the absolute values of normal stresses in point B on top flange are increasing with the fiber angle while the absolute values are reducing with the fiber angle in point B on the web. In order to demonstrate the influence of shear on normal stress distribution, the results obtained by simplified model (no shear) are also presented on Figures 4 and 5. The comparison with FEM has shown excellent agreement for the total fiber angle range.

According to Eqs. (43) and (44), the variation of vertical displacements with the fiber angle, at the mid-span of the simply supported beams is presented in Figure 6. for different stacking sequences.

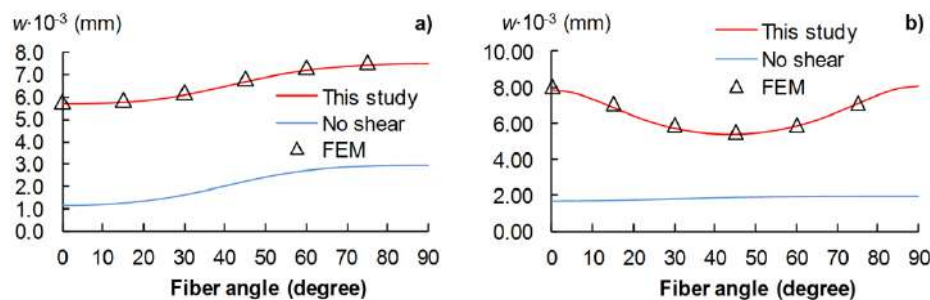


Figure 6. Variation of the vertical displacements at the mid-span of the simply supported beams: a) CASE 1; b) CASE 2.

The vertical displacements are increasing with the fiber angle for the CASE 1. The minimum displacement for this stacking sequence is found for 0° . On the other hand, the minimum displacement for the CASE 2 is found near 45° . Excellent agreement with the results obtained by FEM can be found on Figure 6.

10. Conclusion

Analytic approach to bending with shear influence of thin-walled laminated composite beams with mono-symmetric cross-sections is presented. Beams assembled of balanced laminates with symmetric lay-up are considered. Solutions for the stresses and displacements are derived for composite beams with variable elastic properties over the cross-section area. All the expressions are provided by following derivations presented in general analytic model for thin-walled laminated composite beams with arbitrary cross-sections and with constant elastic properties, and also by following general analytic model for bending analysis with influence of shear of thin-walled beams made of isotropic material.

It is proved that for thin-walled laminated composite beams with variable elastic properties new position of the center of gravity needs to be defined in order to obtain uncoupled differential expressions. For beams made of fiber reinforced plastics the position of the center of gravity depends on orientation of fibers in each layer of laminates in cross-section. Furthermore, all the mechanical properties had to be redefined to include not just geometric properties but material properties as well. Shear factors are also defined with respect to geometric and material properties. Closed-form

solutions for the stresses and displacements of simply supported I-beams, subjected to bending with uniformly distributed load in the plane of symmetry, are provided.

Several examples of mono-symmetric I-beams with low length-to-height aspect ratios are analyzed with respect to the fiber orientation. Distribution of normal stresses on top flange and web provided different values of normal stresses at the junction of the top flange and web due to different elastic properties. Furthermore, results obtained by simplified model (no shear) have shown significant influence of shear on normal stress distribution. Comparison with the results obtained by FEM has shown on the other hand the efficiency of presented analytical model. The influence of shear on the vertical displacements is even more expressed for two different cases of stacking sequences. Comparison with the FEM calculation has provided excellent agreement.

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PERFORMANCE ANALYSIS OF PLATFORM AND IoT DEVICES FOR A TRACEABILITY SYSTEM OF AGRICULTURAL PRODUCTS THAT USES BLOCKCHAIN

Nestor X. Arreaga Alvarado

Universitat Politècnica de València, Camino de Vera s/n, Valencia 46022, Valencia, Spain
and ESPOL Polytechnic University, Escuela Superior Politécnica del Litoral, Campus
Gustavo Galindo Km. 30.5 Vía Perimetral, P.O. Box 09-01-5863 Guayaquil, Ecuador
narreaga@espol.edu.ec

Carlos Cevallos

ESPOL Polytechnic University, Escuela Superior Politécnica del Litoral, Campus Gustavo
Galindo Km. 30.5 Vía Perimetral, P.O. Box 09-01-5863 Guayaquil, Ecuador
carxceva@espol.edu.ec

Isaias Ponce

ESPOL Polytechnic University, Escuela Superior Politécnica del Litoral, Campus Gustavo
Galindo Km. 30.5 Vía Perimetral, P.O. Box 09-01-5863 Guayaquil, Ecuador
ieponce@espol.edu.ec

Sara Blanc

Universitat Politècnica de València, Camino de Vera s/n, Valencia 46022, Valencia, Spain
sablac@disca.upv.es

Abstract. The agricultural sector worldwide is one of the most important economic sectors that allows generating many sources of employment. With technological resources, great benefits can be achieved for agriculture. The traceability of agricultural products can be incorporated, which constitutes a risk management tool since it facilitates the identification of problems in food management and provides specific information on their conditions. Therefore, the information that is handled is of utmost importance for the conservation of the quality of the products. This article analyzes the performance of a platform and the IoT devices used in a system for the traceability of agricultural products that uses Blockchain as a security mechanism to mitigate cyber-attacks. This structure works through the Internet of Things paradigm. The system analyzed in the prototype consisted of a set of sensors whose data was collected by peer-to-peer nodes that functioned as web servers, these reported the information to hypermarket owners and final consumers through a web application. The latency and CPU load of cloud platforms that use blockchain, such as Ethereum, were measured against the low-cost prototype designed, obtaining that the proposed system is 3 seconds faster and consumes five times fewer resources than the platform arranged in the cloud. The CPU load on the Raspberry Pi used as a node was shown to not exceed 10%, showing that it can be eligible as a block within the blockchain. The IoT devices used in this prototype enabled remote monitoring at a low cost, with optimal performance for large amounts of data.

Key words: Traceability, Agricultural products, Blockchain, Internet of Things

1. Introduction

Latin American countries are endowed with a variety of natural resources highly valued and demanded by the international market. For many years, the transformation and commercialization of these resources has been the main economic source of the Latin

American region. Today, this sector still represents an important part of the region's economy (Quinde, F. et al 2018).

In the case of Ecuador, the income received is strongly related to the primary sector, specifically, the agricultural sector (Huachizaca, V. & Alvarado, R. 2018). In this sense, the traceability of agricultural products plays a fundamental role in the management of the supply chain of the Ecuadorian agricultural industry.

Traceability is a risk management tool, since it allows to timely identify problems in food management and provide specific information on agricultural products to consumers or stakeholders (Hernández, I. 2019). In this way, it is possible to meet quality standards and ensure customer loyalty.

However, the traceability carried out in the Ecuadorian agricultural sector is still based on manual processes that depend a lot on the human factor. In fact, the technology used is not as valued as this factor (Alarcón, M. 2019). This situation compromises the information security of the processes themselves, as well as the quality of agricultural products.

Therefore, this work aims to study the security in the traceability of agricultural products using Blockchain and Internet of Things for the mitigation of cyber-attacks. Thus, it would be possible to protect the information of the supply chain of the agricultural sector. Consequently, ensure compliance with quality standards and requirements of stakeholders.

2. Proposal

Regarding traceability, it is necessary to mention that it consists of the ability to keep a detailed record of all the variations that a material, product, model or even a kind of software may experience throughout its useful life (Souali, K., et al. 2016). Traceability makes it easier to safeguard the integrity of the tangible and intangible goods involved in a given process.

In the field of the agri-food industry, traceability is part of a set of stages, generally mandatory during the manufacture of agricultural products. The purpose of compliance with these stages is to obtain recognition or certification in good food safety practices (Díaz, F. et al. 2020).

In that sense and as previously mentioned, some studies seek that traceability is systematized to protect information from possible threats or errors that compromise the activities of the supply chain. In this regard, one of the proposals that has gained acceptance in recent years is the Blockchain (Tian, F. 2016).

The Blockchain consists of a data structure formed by blocks connected chronologically through a previous hash. The blocks, in themselves, represent Blockchain data and headers, which are generated in transactions, smart contracts, among other activities. In the case of agriculture, the blocks originate from the records carried out at each stage of the traceability of the agricultural product (Hua, J. et al. 2018).

In addition, it is worth mentioning that the hash used in the Blockchain corresponds to a set of algorithms, which allow to guarantee the security of the traceability system by encrypting the information. In other words, hashing functions as a mechanism to

preserve the integrity and authenticity of the message at every stage of the process (Zhao, Y. & Cao, N. 2017).

In traceability, generally, the Blockchain is distributed. That is, it works as a peer-to-peer network, whose nodes transmit and agree on transactions through messages. So, there is no central node and, therefore, the Blockchain is characterized by its decentralization (Hua, J. et al. 2018). The latter provides security to the network, since, in case of an attack or threat, the system will not fail at a general level.

Instead of a central node verifying the identity of the other nodes, the network uses digital signature technology, which involves the implementation of encryption algorithms, specifically, asymmetric encryption. This type of encryption involves public and private keys, which work in a complementary way. That is, the public key decrypts the information that was encrypted by the private key and vice versa. In this way, each transactional sensor node of the Blockchain uses asymmetric encryption to indicate the identity of the node by means of its private key, while the public key is within reach of the rest of the nodes (Zhao, Y. & Cao, N. 2017).

Finally, smart devices are key elements for the operation of the Blockchain. For this reason, the paradigm "Internet of Things" is used. This model refers to objects connected to the network through sensors, such as: radio frequency, infrared, GPS, RFID sensors or any other sensed equipment. The function of these devices is basically to collect information that makes possible traceability, management, positioning, among other functionalities (Zhao, Y. & Cao, N. 2017).

The proposed information security system for the traceability of agricultural products using Blockchain on the Internet of Things requires:

Use RFID tags for product identification and traceability.

Design a P2P network of worker nodes in the cloud applying consensus algorithms and Proof of Work.

Design a web application for product tracking visualization.

In order to have precise control over what exactly happens at each stage within traceability, certain aspects concerning the IoT will be taken into account. Therefore, it is necessary to define each stage. Figure 1 presents a proposed model in order to better visualize the stage of the SENSING of the RFID system and the geolocation of the truck.

For a better understanding of the implementation of the information security system in the traceability of agricultural products, it is necessary to know the elements that intervene in the operation of this system.

The hardware proposed for this study is made up of multiple sensors and IoT devices that work together in order to remotely monitor the conditions of agricultural products in the different stages of tracking, such as: Raspberry Pi 3 B+, IP65 Enclosure, RFID Antenna-Reader ZK-RFID 101, Passive RFID Tag TE25, Sensor DHT11, Shield 4G.

The software used aims to implement the blockchain in Amazon Web Services (AWS), therefore it is used: Bootstrap, Chart.js, Python, Flask, Oracle MySQL, Amazon Web Services (AWS), Amazon DynamoDB.

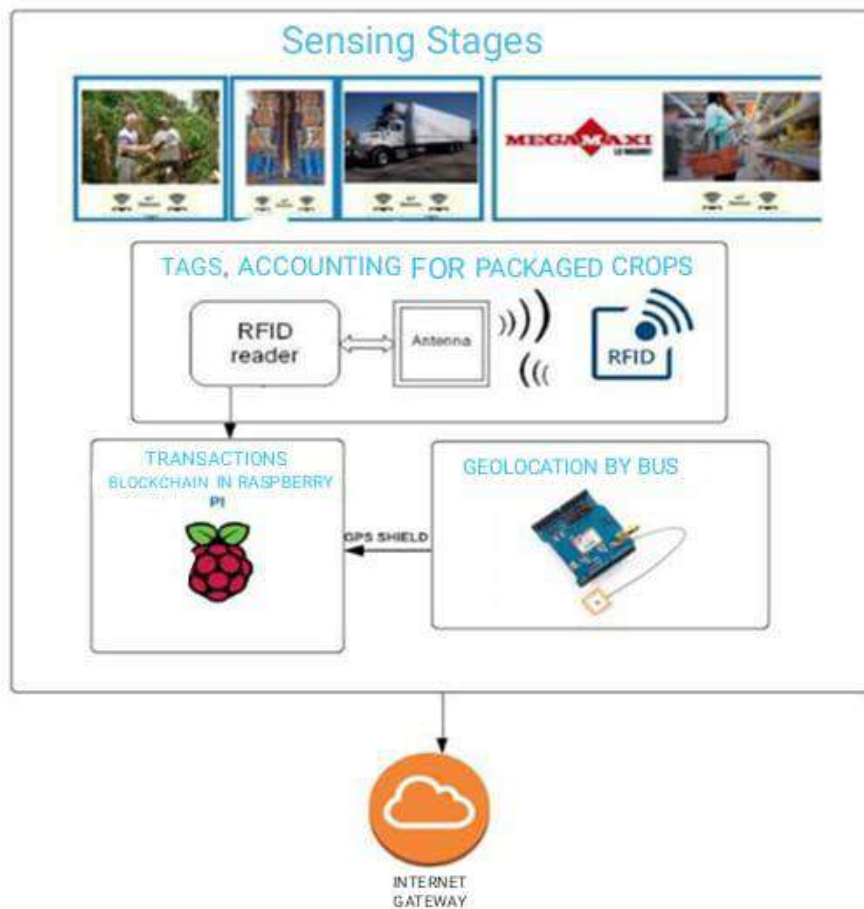


Figure 1 Architecture

At the planting and harvesting stage, farmers would normally have to record details about the number of seeds used. But thanks to weight scales connected to the internet, this process is possible to automate (Pincheira, M., et al. 2016), since that information can be sent directly to the database.

At the registration and processing stage, you will have the help of a web page, where the complete information of the products will be placed, that is, date of elaboration, quantity of products, expiration date, etc. In addition to this, there will be nodes that allow measuring the temperature and humidity variables of the products, managing to upload the information directly to the blockchain.

In the transport stage, RFID tags are required to automate the accounting of packages with the contents of crops. This data is captured and read by the Antenna – RFID Reader, to which an IP address must be established. In this way, it will be part of the node in which the Raspberry PI is also located. Another important device is the Shield 4G for geolocation and mobile internet. In addition, here the temperature and humidity of the products is also measured all the way.

On the other hand, all that collected data is uploaded to the cloud where the Blockchain works and where the Amazon DynamoDB database is also located.

At the end user stage, the collection of all data will be presented, but in a statistical and orderly way within a web page. In such a way that the user can decide whether or not to buy based on the information presented.

In turn, to obtain a correct implementation of Blockchain in the Amazon Web Services (AWS) cloud, the AWS architecture depicted in Figure 2 was built. It implements a virtual private network. Like any security-based system, it is required to have a private cloud (VPC), so that it has layers of abstraction with respect to security and so not just any user can connect publicly.

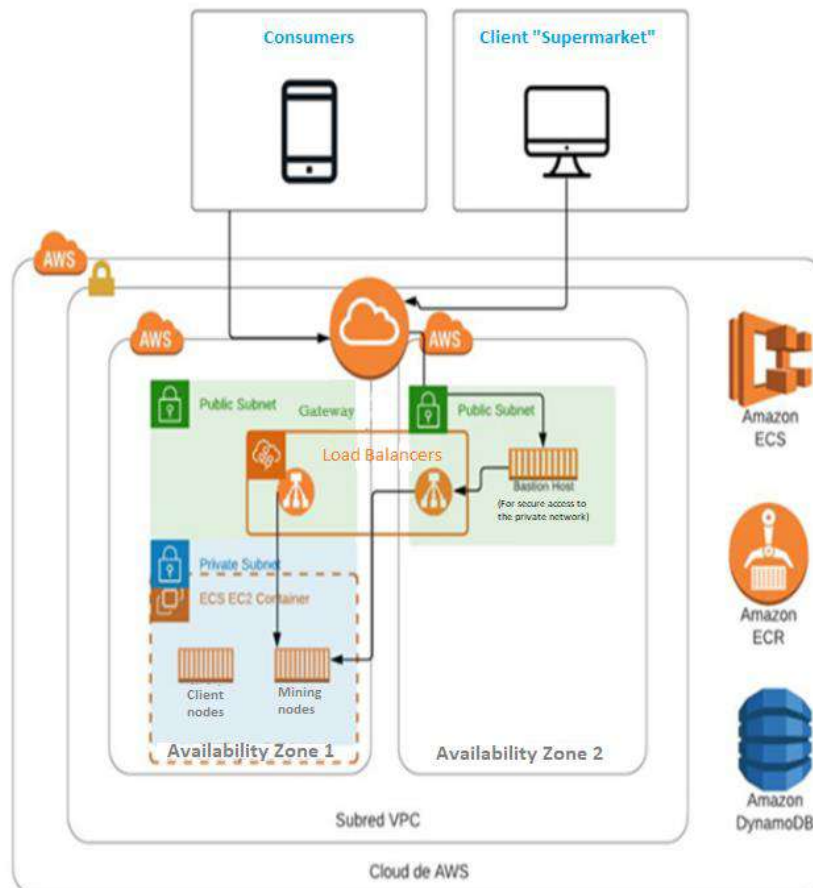


Figure 2 AWS-based schema

The configuration of this architecture requires a public virtual cloud and a public and private subnet, since the web application will be public, while the back-end services are private. This is because, being a private company, it requires that all the "peer to peer" nodes that perform the mining be accessed only by the organization.

Nodes are part of the company; therefore, it is more difficult to execute an attack that affects the blockchain on all nodes. Above all, because for this they need the computational capacity of the attacking nodes to be at least 51% (Bouvarel, L., & Páez, R. 2019), that is, more than half.

Those instances running the mining code are within the private subnet and, in turn, are in the same Availability Zone as the load balancers.

AWS containers make it easy to deploy code, making it easier to design workflows, and with their respective container registry, which makes it easier to store and manage those containers.

In turn, having a decentralized infrastructure hosted in the AWS Cloud facilitates horizontal scaling without having the cost of maintaining centralized servers in the company thanks to the service provided by AWS EC2. Auto-scaling of cloud instances provides a higher state of availability, since there will not be a single server serving all requests; but, depending on the number of requests, server scaling will be automatic. Finally, to securely access the private network from the public subnet to the private network, it is necessary to have a Bastion host, because it is an application that is located on a server in order to offer security to the internal network, provided by AWS (Amazon Web Services, 2020a). So that access is delimited, eliminating possible gateways for the execution of attacks on nodes (Amazon Web Services, 2020b).

3. Implementation

3.1. Mining nodes

Raspberry Pis are treated as nodes that transact with respect to the information that is collected by the sensors. To do this, public and private keys are used, which is the equivalent of the address in Bitcoin, as seen in Figure 3.

The screenshot shows a web application titled "Raspberry Transactional (Sending collected data)". It has navigation links for "Wallet Generator", "Make Transaction", and "View Transactions". The main heading is "Send Sensor Data:" followed by the instruction "Enter transaction details and click the 'Generate Transaction' button:". There are four input fields: "Sender's Public Key" with a long alphanumeric string, "Sender's Private Key" with another long alphanumeric string, "Recipient's Public Key" with a third long alphanumeric string, and "Data" with a JSON-like string: ["temperatura":28, "humedad":46, "latitud": -79.9079500, "longitud": -2.2058400, "ruta": "ruta2", "Estacion": "En granja #4", "fecha". Below these fields is a blue button labeled "Generate Transaction".

Figure 3 Transacting to Mining Nodes on AWS

Figure 3 shows in an illustrative way how the transaction process is caused by a *trigger*, time after the collection of the information (Satoshi, N. 2012). That is, the data is sent automatically, while the transactions are sent to the mining nodes.

On the other hand, in the Figure 4, it is appreciated how the transaction reaches this node with the respective data, such as information from the sensors. In addition to the sender public key and the recipient private key.

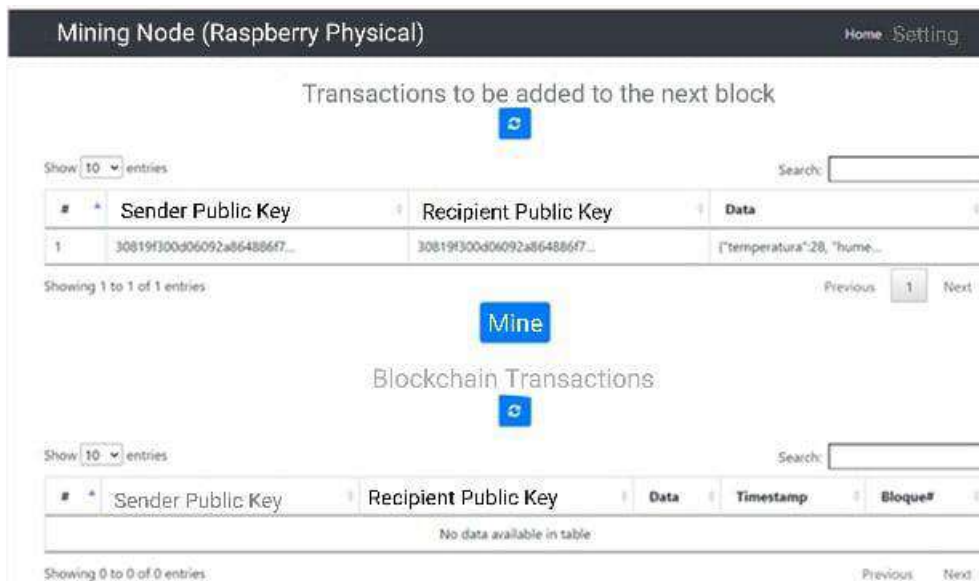


Figure 4 Transactions and Mining on Worker Nodes

The transactions then go through a mining process in which it consists of a hash check, such operations are repetitive iterations to find the correct hash. As it is known, the hash is a representation of a string of characters from another totally different string. That is why it is called "proof of work" at the time of finding said hash. For this reason, there is a difference between Figure 4 and 5, with the current transaction being added to the list of transactions.

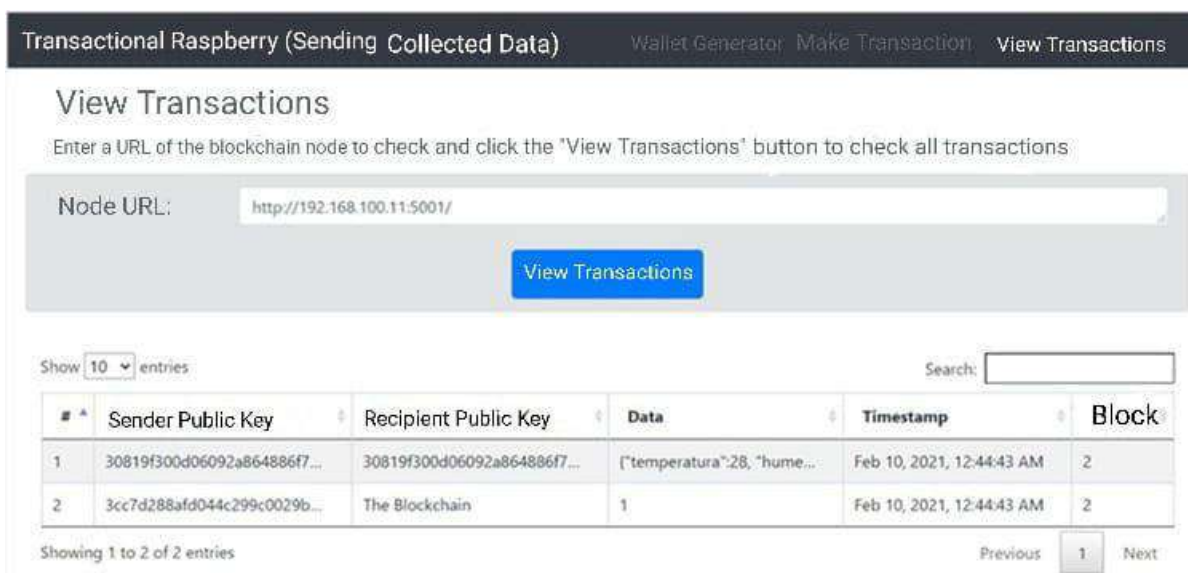


Figure 5 Sending Collected Data

3.2. Interfaces

For the front-end that the final consumer visualizes, Bootstrap was used with the aim of creating it quickly. Subsequently, the HTML, CSS and Javascript files were modified,

establishing the desired behavior and design, which turned out to be friendly to the user and people with relevant privileges.

Because the web application is more focused on end consumers, relevant information of each product was added, in which there is a brief reference of each of them, as well as a description of the company and the traceability and security services provided by the Blockchain implemented. This with the aim that the user knows the importance of using these tools and have total confidence of what he is buying.

Likewise, to keep a more adequate control of customer and product information, a login interface was implemented that allows to distinguish the permissions of each user and thus show more advanced options for people with a higher hierarchical degree.

Finally, there is the interface of the flow tab, in which more relevant data are presented and that will help the consumer to decide whether to buy a product. Specifically, Figure 6 has a statistical graph on the temperature and humidity that the product presents in the stages of traceability. For the distribution stage there is a geolocation device, the information is provided by the node that is in the truck at the time of leaving for its destination, allowing to visualize the route in real time through a graph on the website.

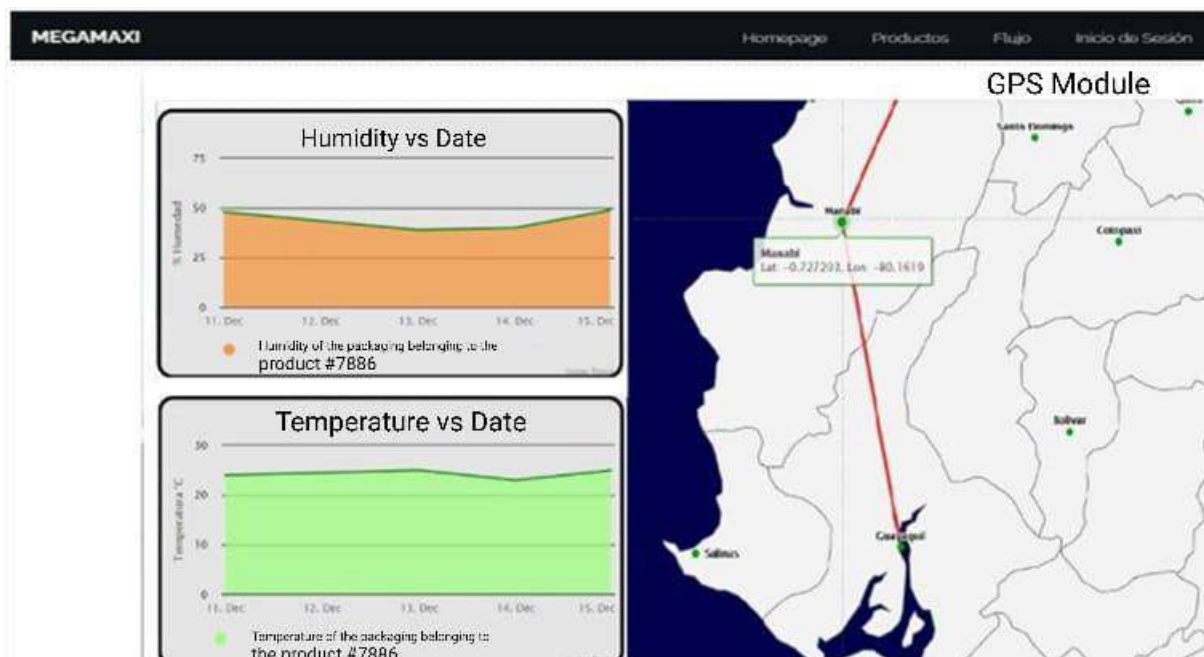


Figure 6 Path Information

4. Results

4.1. Performance

The performance tests consist of sending information periodically through the peer-to-peer network and depending on the phase or scenario in which it is, the information consulted may have more or less data to present. So, it is put to the test how quickly it is achieved.

According to Figure 7, the average time it takes to query information at each stage of the process will differ from the amount of data hosted in those stages (harvesting, recording, packaging, distribution). It should be noted that in the distribution stage it

will take longer to obtain such a query but being a time difference in the order of milliseconds with respect to the other stages, it will not represent a time perceived by the user.

The benefit of this metric is according to the user experience, since the objective is that this page can receive many requests without having a performance penalty.

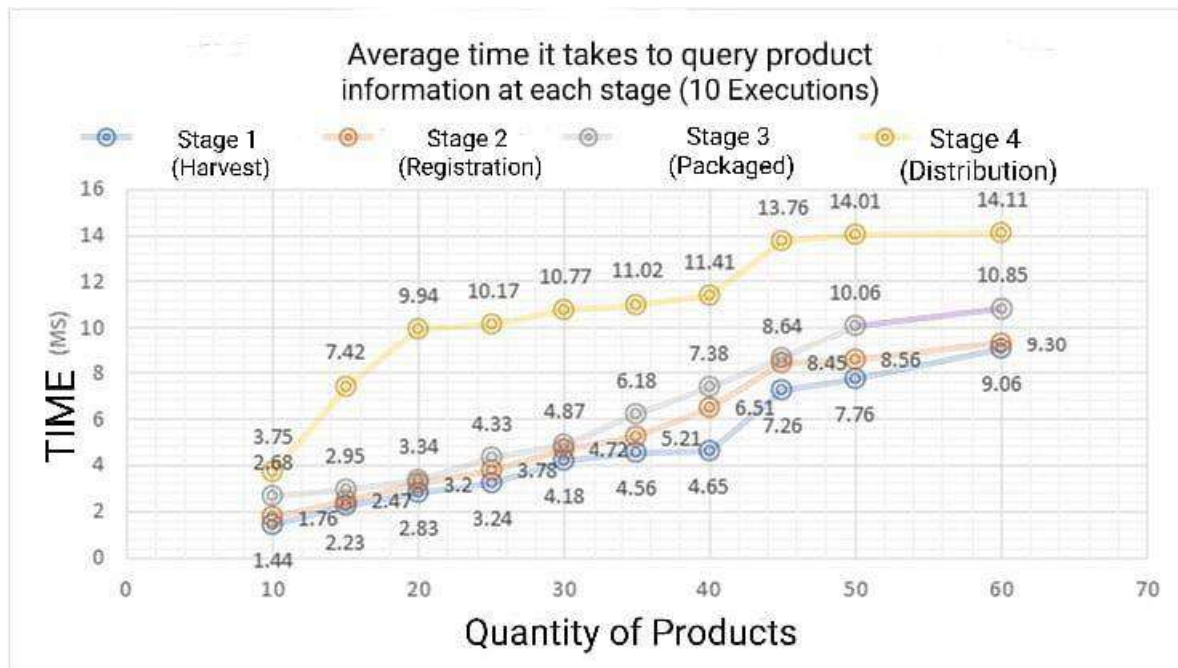


Figure 7 Performance Testing

The CPU load of a Raspberry PI was also evaluated in different stress scenarios. That is, the more information was processed, how much the CPU percentage rose using Linux commands.

The web application performs necessary algorithms in Blockchain that, when executed, the CPU load increases when making transactions and adding them to the Blockchain, as shown in Figure 8. Observing the results, it is notorious the fact that, despite handling many transactions, the CPU load does not exceed approximately 10%, demonstrating that it is not inconvenient in the implementation on Raspberry PI.

4.2. Study limitations

Originally in the investigation it was considered that the structure of the tables for the database included the information of the users and the products. Per it was observed that, the update of the information of the products would be more frequent than that of the users, which this combined information would cause an overload in the database. As well as the breach of characteristics such as consistency, availability, and fault tolerance. In response to this, it was decided to separate the database into two different types of databases: users and products, so that it can meet these characteristics and achieve good performance.

By nature, the blocks of the chain can be manipulated, affecting the performance of the raspberry pi. Therefore, consensus algorithms were implemented in the peer-to-

peer network. These algorithms were used in each blockchain node to ensure that the information about the products is not altered during the traceability process.

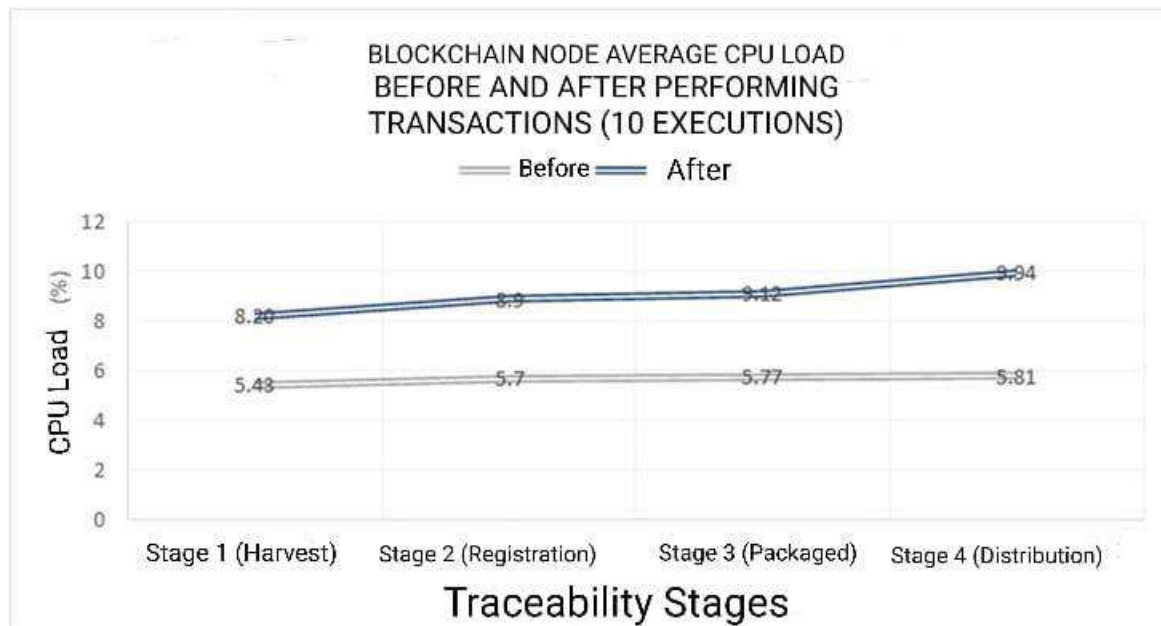


Figure 8 Average CPU Load Time to Perform Transactions

Respecting latency times due to the number of hops cannot be evaluated by being in a test environment and not in an actual production space. That said, comparisons are made with cloud platforms that make use of Blockchain, such as Ethereum. In the previously mentioned study (Hua, J. et al. 2018), 100 tests were run with Ethereum and in terms of CPU load percentage, it can be said to represent an advantage. However, this value depends mainly on the characteristics of the machines that perform the Blockchain algorithms, and also depends on the number of nodes. This is because, by increasing this amount, the number of transactions that all the nodes in the network should process also increases.

Table 1 Latency and load results by type of cloud platform.

Cloud platform	Latency [seconds]	CPU load [%]
Ethereum	16.55	46.78
Proposed system	1.4 - 14.11	5.43 - 9.94

4.3. User Experience

This section evaluated how interactive the website was for users. A sample of 10 people was taken into consideration. We estimated the time to perform each of the tasks.

The average time it takes to perform a task in the web application is given in accordance with Figure 9, showing a longer time to register a user, because it is necessary to perform email validations under the company domain removing fluidity in the registration interface.

To check graphics, it is necessary to search by the product identifier, so that the environmental conditions to which the product is subjected can be visualized. And finally, to view transactions, a captcha verification is necessary, since read access should be as restricted as possible. So only information technology personnel will be able to access.

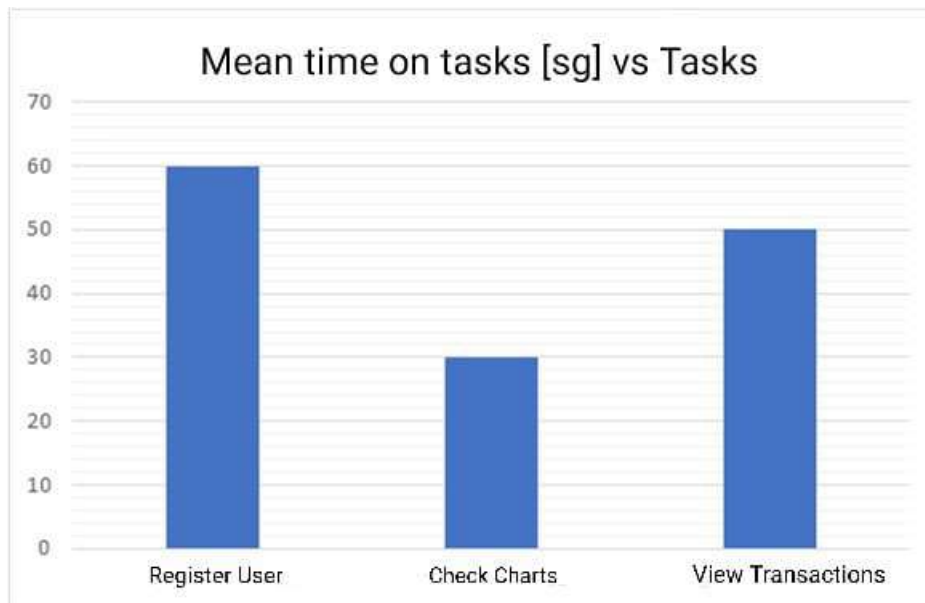


Figure 9 Average Time to Perform a Task in the Web Application

5. Conclusions

This article presents an application of the Internet of Things with Blockchain. The Internet of Things devices used in the proposal allowed remote monitoring at low cost, and with optimal performance for large amounts of data, which means an improvement in the control of product information obtained at each stage of the traceability process. The solution has been integrated with a software development for supermarkets where customers can access the trace information of the different products included in the system.

The solution has been tested at different levels, both performance and user experience with good results.

According to the results obtained, the latency of the proposed system is an average of 7.75 seconds and the platform in the Ethereum cloud is 16.55. As well as it was observed that the CPU load in the cloud platform is approximately 40% higher than the load that is generated in the CPU of the proposed system.

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AN EFFICIENT WAY TO SOLVE PLAIN STRESS PROBLEMS WITH 2D ISOPARAMETRIC QUADRILATERAL LINEAR FINITE ELEMENT USING MATLAB

Boris Mikulić

University of Split, University Department of Professional Studies, Split, Croatia
bmikulic@oss.unist.hr

Abstract. This paper aims to provide an efficient algorithm for solving plain stress problems with the 2D isoparametric quadrilateral linear finite element using MATLAB. Even though there are a lot of commercial and open-source software packages for finite element analysis on the market, the use of programs like MATLAB is indispensable in educational and research work. However, in cases when a large number of elements or nodes are required for the analysis, the application of an inadequate algorithm very quickly leads to extremely slow, and in some cases completely unusable code. The reason for this problem is implementing code with large for loops which executes very slow in MATLAB. To avoid this kind of problem the use of vectorized implementation which avoids loops over the elements is necessary. The method discussed in this paper is based on assembling three-dimensional strain displacement and Jacobian matrix in the form of MATLAB cell-array data type for all elements as a function of vectorized node elements coordinates and gauss integration points. Isoparametric quadrilateral linear element makes numeric Gauss integration over element volumes very easy which makes this type of element very suitable for this algorithm. In this way, the stiffness matrix can be evaluated for every integration point with matrix and vector products using small for loops and adding them together to get the overall stiffness matrix. For a large number of elements, there are a lot of zero entries in the global stiffness matrix, so the sparse matrix algorithm which requires less computational time and less computer memory is applied. Implementation of boundary conditions and assembling of the global force vector is also discussed.

Key words: *Isoparametric quadrilateral element, FEM, MATLAB*

1. Introduction

In modern engineering, research and educational Finite Element Analysis become one of the most frequently used techniques for solving problems in structural analysis. Finite element codes can be developed in modern languages like C, C++, or Fortran, but high-level computational environments like MATLAB often are a better choice because they require fewer lines of code and less overall programming effort. But improper use of MATLAB for Finite Element Analysis can lead to very poor performant code which sometimes becomes unusable. MATLAB is very slow in executing for loops through a large array but on the other hand, is highly optimized in vectorized array and matrix operations using the LAPACK/BLAS backend [1]. It is necessary to apply the vectorized approach to Finite Element Analysis to achieve very fast and efficient code. This paper extends the assembly of FEM matrices proposed in [2] to a 2D isoparametric quadrilateral linear finite element using MATLAB cell arrays and numeric Gauss integration. An approach that is taken in this paper also improves the assembly of the global stiffness matrix.

2. Finite Element Formulation of the plane stress problem

Plane stress represents a simplification in solid mechanics that we can use to reduce 3D problem to 2D problem which is often much easier to solve. Plane stress conditions exist when the thickness dimension (usually the z-direction) is much smaller than the length and width dimensions of a solid. Since stress at the two surfaces normal to the z-axis are zero, it is assumed that stresses in the normal direction are zero throughout the body i.e. $\sigma_{zz} = \sigma_{xz} = \sigma_{yz} = 0$. In such case, the structure case, the structure can be modeled in two dimensions.

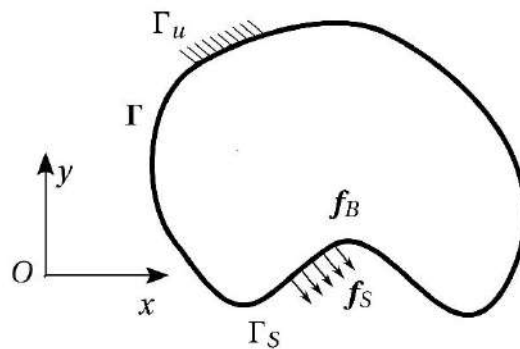


Figure 1. An elastic plate of thickness t in plane stress

The Total Potential Energy An elastic plate of thickness t in plane stress subjected to a body force \mathbf{f}_B over the domain Ω , surface tractions imposed on the boundary, and prescribed displacements \mathbf{u}_p imposed on the boundary Γ_u is given by

$$\Pi = U - W \quad (1)$$

The internal energy can be expressed in terms of the strains only as

$$U = \frac{1}{2} \int_{\Omega} t \boldsymbol{\sigma}^T \boldsymbol{\varepsilon} d\Omega = \frac{1}{2} \int_{\Omega} t \boldsymbol{\varepsilon}^T \mathbf{C} \boldsymbol{\varepsilon} d\Omega \quad (2)$$

Where t is thickness of the plate, $\boldsymbol{\sigma}$ stress vector, $\boldsymbol{\varepsilon}$ strain vector and \mathbf{C} the stress-strain matrix or elasticity matrix. For linear isotropic materials in plain stress conditions, the stress-strain relation can be written as $\boldsymbol{\sigma} = \mathbf{C} \boldsymbol{\varepsilon}$ with

$$\mathbf{C} = \frac{E}{1-\nu^2} \begin{bmatrix} 1 & \nu & 0 \\ \nu & 1 & 0 \\ 0 & 0 & 1+\nu \end{bmatrix}, \quad \boldsymbol{\varepsilon} = \begin{Bmatrix} \varepsilon_{xx} \\ \varepsilon_{yy} \\ \varepsilon_{xy} \end{Bmatrix}, \quad \boldsymbol{\sigma} = \begin{Bmatrix} \sigma_{xx} \\ \sigma_{yy} \\ \sigma_{xy} \end{Bmatrix} \quad (3)$$

The external energy (potential of the applied forces) is the sum of contributions from the given interior (body) and exterior (boundary) forces:

$$W = \int_{\Omega} t \mathbf{u}^T \mathbf{f}_B d\Omega + \int_{\Gamma_t} t \mathbf{u}^T \mathbf{f}_t d\Gamma \quad (4)$$

where \mathbf{u} is displacement field which satisfies boundary conditions $\mathbf{u} = \mathbf{u}_p$ and where connection between the displacement and the strain is given by

$$\boldsymbol{\varepsilon} = \mathbf{D}\mathbf{u} \quad (5)$$

with

$$\mathbf{D} = \begin{bmatrix} \partial/\partial x & 0 \\ 0 & \partial/\partial y \\ \partial/\partial y & \partial/\partial x \end{bmatrix}, \boldsymbol{\varepsilon} = \begin{Bmatrix} \varepsilon_{xx} \\ \varepsilon_{yy} \\ \varepsilon_{xy} \end{Bmatrix}, \mathbf{u} = \begin{Bmatrix} u \\ v \end{Bmatrix} \quad (6)$$

Note that the boundary integral is taken only over Γ_t . That is, the portion of the boundary over which tractions are specified.

Inserting (2),(4) in (1) total potential energy is defined as

$$\Pi = \frac{1}{2} \int_{\Omega} t\boldsymbol{\varepsilon}^T \mathbf{C} \boldsymbol{\varepsilon} d\Omega - \int_{\Omega} t\mathbf{u}^T \mathbf{f}_B d\Omega - \int_{\Gamma_t} t\mathbf{u}^T \mathbf{f}_\Gamma d\Gamma \quad (7)$$

After finite element discretization of domain Ω we can extract one element labeled with e . The displacement field over the element is interpolated from node displacement with

$$\mathbf{u}(x, y) = \mathbf{N}\mathbf{u}^e \quad (8)$$

where \mathbf{N} is the shape function matrix and \mathbf{u}^e is the node displacement vector. Strain displacement relation in the element can be given as

$$\boldsymbol{\varepsilon}(x, y) = \mathbf{D}\mathbf{N}\mathbf{u}^e = \mathbf{B}\mathbf{u}^e \quad (9)$$

where \mathbf{B} is strain-displacement matrix. If we denote domain of the element e with Ω^e and its boundary with Γ^e total potential energy of element e is defined as

$$\Pi^e = \frac{1}{2} \int_{\Omega^e} t\boldsymbol{\varepsilon}^T \mathbf{C} \boldsymbol{\varepsilon} d\Omega^e - \int_{\Omega^e} t\mathbf{u}^T \mathbf{f}_B d\Omega^e - \int_{\Gamma_t} t\mathbf{u}^T \mathbf{f}_\Gamma d\Gamma^e \quad (10)$$

Then inserting (8) , (9) and minimizing functional Π^e we get

$$\int_{\Omega^e} t\mathbf{B}^T \mathbf{C} \mathbf{B} d\Omega^e = \int_{\Omega^e} t\mathbf{N}^T \mathbf{f}_B d\Omega^e + \int_{\Gamma_t} t\mathbf{N}^T \mathbf{f}_\Gamma d\Gamma^e \quad (11)$$

or

$$\mathbf{K}^e \mathbf{u}^e = \mathbf{f}^e \quad (12)$$

where element stiffness matrix is defined by

$$\mathbf{K}^e = \int_{\Omega^e} t \mathbf{B}^T \mathbf{C} \mathbf{B} d\Omega^e \quad (13)$$

and element nodal force vector is

$$\mathbf{f}^e = \int_{\Omega^e} t \mathbf{N}^T \mathbf{f}_B d\Omega^e + \int_{\Gamma_i} t \mathbf{N}^T \mathbf{f}_T d\Gamma^e \quad (14)$$

3. Isoparametric quadrilateral linear finite element

Four–node quadratic isoparametric finite element is one of the most used elements in engineering applications. A mesh consisting of quadrilateral elements can be used to approximate any arbitrary shape in two dimensions. The terms “isoparametric” comes from the fact that the same interpolation scheme is used for interpolating both the displacement and geometry. Isoparametric elements involve the mapping of the element from a global coordinate system to natural coordinate system. If interpolation or shape functions are written in natural $\xi - \eta$ coordinates as

$$\begin{aligned} N_1(\xi, \eta) &= \frac{1}{4}(1-\xi)(1-\eta) & N_2(\xi, \eta) &= \frac{1}{4}(1+\xi)(1-\eta) \\ N_3(\xi, \eta) &= \frac{1}{4}(1+\xi)(1+\eta) & N_4(\xi, \eta) &= \frac{1}{4}(1-\xi)(1+\eta) \end{aligned} \quad (15)$$

The relation between $x - y$ and $\xi - \eta$ coordinates can be expressed as

$$x = \sum_{i=1}^4 N_i(\xi, \eta) x_i \quad y = \sum_{i=1}^4 N_i(\xi, \eta) y_i \quad (16)$$

where x_i, y_i denotes coordinates of the element corner nodes i.e.

$$\begin{Bmatrix} x \\ y \end{Bmatrix} = \begin{bmatrix} N_1 & 0 & N_1 & 0 & N_1 & 0 & N_1 & 0 \\ 0 & N_1 & 0 & N_1 & 0 & N_1 & 0 & N_1 \end{bmatrix} \begin{Bmatrix} x_1 \\ y_1 \\ x_2 \\ y_2 \\ x_3 \\ y_3 \\ x_4 \\ y_4 \end{Bmatrix} = \mathbf{N} \mathbf{x} \quad (17)$$

Because the same interpolation scheme is used for interpolating displacements they can be expressed as

$$u = \sum_{i=1}^4 N_i(\xi, \eta) u_i \quad v = \sum_{i=1}^4 N_i(\xi, \eta) v_i \quad (18)$$

which can be written in the matrix form as

$$\begin{Bmatrix} u \\ v \end{Bmatrix} = \begin{bmatrix} N_1 & 0 & N_1 & 0 & N_1 & 0 & N_1 & 0 \\ 0 & N_1 & 0 & N_1 & 0 & N_1 & 0 & N_1 \end{bmatrix} \begin{Bmatrix} u_1 \\ v_1 \\ u_2 \\ v_2 \\ u_3 \\ v_3 \\ u_4 \\ v_4 \end{Bmatrix} = \mathbf{N}\mathbf{u} \quad (19)$$

In quadrilateral element derivations we will need to define relationship between natural and global coordinate system. Using the chain rule this relationship is expressed as

$$\begin{Bmatrix} \frac{\partial N_i}{\partial \xi} \\ \frac{\partial N_i}{\partial \eta} \end{Bmatrix} = \begin{bmatrix} \frac{\partial x}{\partial \xi} & \frac{\partial y}{\partial \xi} \\ \frac{\partial x}{\partial \eta} & \frac{\partial y}{\partial \eta} \end{bmatrix} \begin{Bmatrix} \frac{\partial N_i}{\partial x} \\ \frac{\partial N_i}{\partial y} \end{Bmatrix} = \mathbf{J} \begin{Bmatrix} \frac{\partial N_i}{\partial x} \\ \frac{\partial N_i}{\partial y} \end{Bmatrix} = \begin{bmatrix} J_{11} & J_{12} \\ J_{21} & J_{22} \end{bmatrix} \begin{Bmatrix} \frac{\partial N_i}{\partial x} \\ \frac{\partial N_i}{\partial y} \end{Bmatrix} \quad (20)$$

where \mathbf{J} is Jacobian matrix of (x, y) with respect to (ξ, η) and can be evaluated for each element from its nodes coordinates as

$$\begin{aligned} J_{11} &= x_1(-1+\eta)/4 + x_2(1-\eta)/4 + x_3(1+\eta)/4 + x_4(-1-\eta)/4 \\ J_{12} &= x_1(-1+\xi)/4 + x_2(-1-\xi)/4 + x_3(1+\xi)/4 + x_4(1-\xi)/4 \\ J_{21} &= y_1(-1+\eta)/4 + y_2(1-\eta)/4 + y_3(1+\eta)/4 + y_4(-1-\eta)/4 \\ J_{22} &= y_1(-1+\xi)/4 + y_2(-1-\xi)/4 + y_3(1+\xi)/4 + y_4(1-\xi)/4 \end{aligned} \quad (21)$$

Inverse Jacobian is given by

$$\mathbf{J}^{-1} = \begin{bmatrix} \frac{\partial \xi}{\partial x} & \frac{\partial \eta}{\partial x} \\ \frac{\partial \xi}{\partial y} & \frac{\partial \eta}{\partial y} \end{bmatrix} = \frac{1}{\det(\mathbf{J})} \begin{bmatrix} J_{22} & -J_{12} \\ -J_{21} & J_{11} \end{bmatrix} \quad (22)$$

where $\det(\mathbf{J}) = |\mathbf{J}| = J_{11}J_{22} - J_{12}J_{21}$

Reordering equation (5) as

$$\boldsymbol{\varepsilon} = \begin{Bmatrix} \varepsilon_{xx} \\ \varepsilon_{yy} \\ \varepsilon_{xy} \end{Bmatrix} = \begin{bmatrix} 1 & 0 & 0 & 0 \\ 0 & 0 & 0 & 1 \\ 0 & 1 & 1 & 0 \end{bmatrix} \begin{Bmatrix} \frac{\partial u}{\partial x} \\ \frac{\partial u}{\partial y} \\ \frac{\partial v}{\partial x} \\ \frac{\partial v}{\partial y} \end{Bmatrix} \quad (23)$$

and considering (19) relation between strain end displacement of element nodes can be written as

$$\boldsymbol{\varepsilon} = \begin{bmatrix} 1 & 0 & 0 & 0 \\ 0 & 0 & 0 & 1 \\ 0 & 1 & 1 & 0 \end{bmatrix} \begin{bmatrix} \frac{\partial \xi}{\partial x} & \frac{\partial \eta}{\partial x} & 0 & 0 \\ \frac{\partial \xi}{\partial y} & \frac{\partial \eta}{\partial y} & 0 & 0 \\ 0 & 0 & \frac{\partial \xi}{\partial x} & \frac{\partial \eta}{\partial x} \\ 0 & 0 & \frac{\partial \xi}{\partial y} & \frac{\partial \eta}{\partial y} \end{bmatrix} \begin{bmatrix} \frac{\partial N_1}{\partial \xi} & 0 & \frac{\partial N_2}{\partial \xi} & 0 & \frac{\partial N_3}{\partial \xi} & 0 & \frac{\partial N_4}{\partial \xi} & 0 \\ \frac{\partial N_1}{\partial \eta} & 0 & \frac{\partial N_2}{\partial \eta} & 0 & \frac{\partial N_3}{\partial \eta} & 0 & \frac{\partial N_4}{\partial \eta} & 0 \\ 0 & \frac{\partial N_1}{\partial \xi} & 0 & \frac{\partial N_2}{\partial \xi} & 0 & \frac{\partial N_3}{\partial \xi} & 0 & \frac{\partial N_4}{\partial \xi} \\ 0 & \frac{\partial N_1}{\partial \eta} & 0 & \frac{\partial N_2}{\partial \eta} & 0 & \frac{\partial N_3}{\partial \eta} & 0 & \frac{\partial N_4}{\partial \eta} \end{bmatrix} \begin{Bmatrix} u_1 \\ v_1 \\ u_2 \\ v_2 \\ u_3 \\ v_3 \\ u_4 \\ v_4 \end{Bmatrix} = \mathbf{B}\mathbf{u}^e \quad (24)$$

or together with (22) and (15) strain displacement matrix \mathbf{B} is given by

$$\mathbf{B}(\xi, \eta, \mathbf{x}) = \frac{1}{|\mathbf{J}|} \begin{bmatrix} J_{22} & -J_{12} & 0 & 0 \\ 0 & 0 & -J_{21} & J_{11} \\ -J_{21} & J_{11} & J_{22} & -J_{12} \end{bmatrix} \begin{bmatrix} \frac{-1+\eta}{4} & 0 & \frac{1-\eta}{4} & 0 & \frac{1+\eta}{4} & 0 & \frac{-1-\eta}{4} & 0 \\ \frac{-1+\xi}{4} & 0 & \frac{-1-\xi}{4} & 0 & \frac{1+\xi}{4} & 0 & \frac{1-\xi}{4} & 0 \\ 0 & \frac{-1+\eta}{4} & 0 & \frac{1-\eta}{4} & 0 & \frac{1+\eta}{4} & 0 & \frac{-1-\eta}{4} \\ 0 & \frac{-1+\xi}{4} & 0 & \frac{-1-\xi}{4} & 0 & \frac{1+\xi}{4} & 0 & \frac{1-\xi}{4} \end{bmatrix} \quad (25)$$

as a function of natural coordinates and global coordinates of element nodes. Element stiffness matrix can be evaluated from (13) and considering that $d\Omega^e = dx dy = \det(\mathbf{J}) d\xi d\eta$ yields

$$\mathbf{K}^e = t \int_{\xi=-1}^{\xi=+1} \int_{\eta=-1}^{\eta=+1} \mathbf{B}^T(\xi, \eta, \mathbf{x}) \mathbf{C} \mathbf{B}(\xi, \eta, \mathbf{x}) \det(\mathbf{J}) d\xi d\eta \quad (26)$$

For practical evaluation of integrals over isoparametric element domains the standard practice is to use *Gauss integration*. Using 2x2 integration scheme with four integration points located at $\xi_i = \pm 0.57735$ and $\eta_i = \pm 0.57735$ with each point having a weight of 1.0 element stiffness matrix can be evaluated as

$$\mathbf{K}^e \approx t \sum_{i=1}^2 \sum_{j=1}^2 W_i W_j \mathbf{B}^T(\xi_i, \eta_j, \mathbf{x}) \mathbf{C} \mathbf{B}(\xi_i, \eta_j, \mathbf{x}) \det(\mathbf{J}(\xi_i, \eta_j, \mathbf{x})) d\xi d\eta \quad (27)$$

In addition to stiffness matrix nodal forces due to body forces and traction vectors should be determined

$$\mathbf{f}^e = t \int_{\xi=-1}^{\xi=+1} \int_{\eta=-1}^{\eta=+1} \mathbf{N}^T(\xi, \eta) \mathbf{f}_B \det(\mathbf{J}) d\xi d\eta + \int_{\Gamma_i} t \mathbf{N}^T \mathbf{f}_T d\Gamma^e \quad (28)$$

4. MATLAB implementation

For efficient MATLAB implementation of Finite Element Analysis, in this case analysis of the plain stress problem key is concept of vectorization. Vectorization means that all data that describe parts of Finite Element Analysis are stored in vectors or composition of vectors for the whole systems at once. That leads to avoiding long for loops which makes MATLAB code very slow and sometimes completely unusable.

Let's consider a mesh of quads composed of NP nodes and NELI elements. This mesh is completely defined with array of node coordinates **COORD** which dimension is NPx2 and array of nodes that belongs to each element **ELEM** which dimension is NELx4.

Plain stress problems with 2d isoparametric quadrilateral element can be efficiently solved using

Algorithm for solving plain stress problem with the 2D isoparametric quadrilateral linear finite element

- 1: Define mesh with **COORD** and **ELEM** array
- 2: Extract node coordinates of each element in the appropriate vectors **X**, **Y** *nel*
- 3: Initialize empty cell-array **KEL** to store stiffness matrices for all elements in one cell array
- 4: **for** each Gauss integration point **do**
- 4: Calculate Jacobian for all elements and store them in appropriate cell array
- 5: Calculate the inverse of Jacobian for all elements and store them in cell array as well
- 6: Calculate derivation of shape function
- 7: Calculate the **B** matrix from (25) for all elements as a single cell-array
- 8: Calculate the matrix **E = CB** for all elements as a single cell-array
- 9: Calculate the part of **KEL = KEL + B^TE** for current Gauss integration point
- 10: **end for**
- 11: Initialize global stiffness matrix **KG** as a sparse matrix to enhance computational performances
- 12: Assemble under diagonal elements of **KG**
- 13: Assemble diagonal elements of **KG** as a separate vector **DIAG**
- 14: Obtain the final global stiffness matrix **KG = KG + KG^T + DIAG * I** where **I** is the identity matrix of the same dimension as **KG**
- 15: Calculate external forces vector **F** (28)

- 16: Apply essential boundary conditions (prescribed displacements \mathbf{u}_p)
 17: Solve the system of equations $\mathbf{KG}*\mathbf{U}=\mathbf{F}$ to get a vector of nodal displacements
 18: Find strains and stress from nodal displacements

Complete MATLAB implementation of this algorithm can be found and downloaded from [8].

5. Numerical comparisons

Method for calculation proposed in this paper is improvement of implementation proposed by J. Koko [2] in sense that stiffness matrices for all elements are calculated as a cell-array, and after that global stiffness matrix is assembled. In Table 1 we compare times needed for assembling of elasticity global stiffness matrix for 2D triangular P^1 finite element

Table 1 Comparison of global matrix assembly speed with [2]

Number of nodes	Number of elements	Time needed to assemble global stiffness with code form [2]	Time needed to assemble global stiffness matrix with method from this paper (s)
150000	298402	0.870264	0.730154
337500	672602	2.089381	1.785806
600000	1196802	3.778026	3.222724
1350000	2695202	9.305208	7.943908

As it can be noticed, method proposed in this paper is about 15% faster. For elements that require Gauss integration this difference is much larger.

Second comparison is provided regarding the method proposed in paper [6] by Cermak, Sysala and Valdman. This comparison is performed using the code from Github repository [7] for assembling global stiffness matrix for isoparametric quadrilateral linear finite element Q1.

Table 2 Comparison of global matrix assembly speed with [6]

Number of nodes	Number of elements	Time needed to assemble global stiffness with code form [6] (s)	Time needed to assemble global stiffness matrix with method from this paper (s)
77441	76800	0.492444	0.305090
337500	307200	1.999346	1.372827
1231361	1228800	8.739069	5.533658
4920321	4915200	out of memory	24.084171

Data from this table shows that method proposed in this paper outperforms code from [7]. MATLAB code used for this comparison is available at repository [8].

The performance of the code was tested with MATLAB R2021b on a computer with Intel(R) Core(TM) i7-8700 CPU @ 3.20GHz 3.19 GHz processor, 16 GB RAM, and 256 GB SSD hard disk memory.

6. Computational example

To illustrate efficiency of proposed MATLAB implementation stress concentration in tension strip with opposite semicircular edge notches Fig. 5 is considered.

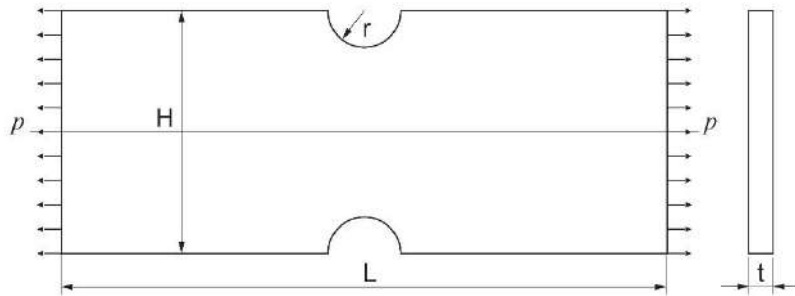


Figure 2 Tension strip

For this analysis following data are given

$p = 20 \text{ N/mm}^2$, $l = 100 \text{ mm}$, $r = 12 \text{ mm}$, $t = 5 \text{ mm}$, $E = 210000 \text{ MPa}$, $\nu = 0.3$, From [9] maximal stress can be calculated as

$$\sigma_{\max} = K_t \sigma_{\text{nom}}$$

where

$$\sigma_{\text{nom}} = \frac{F}{(H-2r)t} = \frac{pHt}{(H-2r)t} = \frac{20 \cdot 80 \cdot 5}{(80 - 2 \cdot 12) \cdot 5} = 28.5714 \text{ MPa}$$

$$K_t = 3.065 - 3.472 \left(\frac{2r}{H} \right) + 1.009 \left(\frac{2r}{H} \right)^2 + 0.405 \left(\frac{2r}{H} \right)^3 = 2.1251$$

which finally give as $\sigma_{\max} = 60.7184 \text{ MPa}$

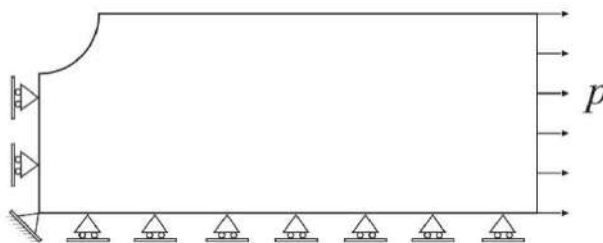


Figure 3 Symmetry of strip

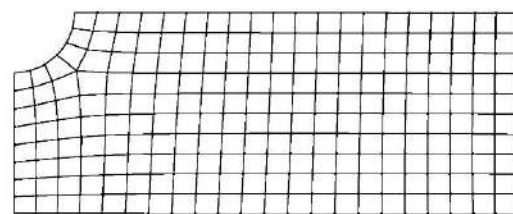


Figure 4 Initial mesh

Considering the symmetry of strip only one quarter will be analysed as it is shown at Fig. 3. Initial mesh is shown at Fig.4. Finer meshes are refined by splitting of the initial mesh. Results of the analysis and the computational times are shown in Table 1.

Table 3 Computing results for stress concentration in tension strip Fig 2.

Number of nodes	Number of elements	Time needed to solve system of equations (s)	Maximal stress value (MPa)
251	217	0.012541	60.6581
935	868	0.016136	61.8140
3605	3472	0.028789	61.7098
14153	13888	0.136828	61.4459
56081	55552	0.467166	61.2451
223265	222208	6.195419	61.1226
890945	888832	28.184412	61.0546

As it can be noticed results for maximal stress at concentration point is very close to the solution calculated with stress concentration factor. Distribution of stresses in the load direction is shown at Fig.5

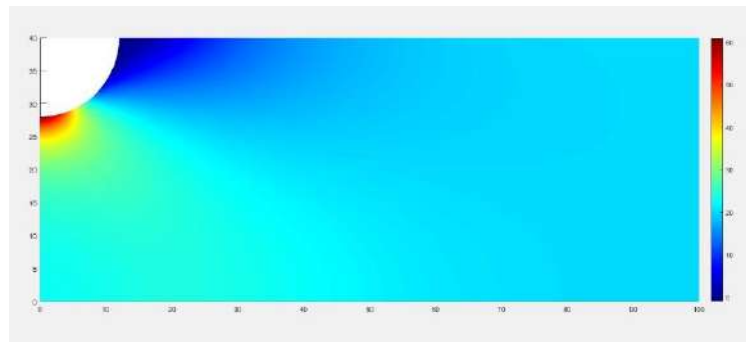


Figure 5 Distribution of stresses in the load direction

8. Conclusion

In this paper efficient method for solving plain stress problems with Finite Element Analysis in MATLAB is presented. To enhance the speed of calculations concept of vectorization is used. Obtained numeric results shows that this method is very fast and can be used to solve problems for which solution very fine mesh is needed.

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INPUT DATA QUANTIZATION FOR REAL TIME SIGNAL VS BACKGROUND CLASSIFICATION USING QUANTIZED NEURAL NETWORK

Arijana Burazin Mišura

University Department of Professional Studies, Split, Croatia
aburazin@oss.unist.hr

Julije Ožegović

Faculty of Electrical Engineering, Mechanical Engineering and Naval Architecture, Split, Croatia

Josip Musić

Faculty of Electrical Engineering, Mechanical Engineering and Naval Architecture, Split, Croatia
jmusic@fesb.hr

Damir Lelas

Faculty of Electrical Engineering, Mechanical Engineering and Naval Architecture, Split, Croatia
dlelas@fesb.hr

Abstract. The volume of data generated as a result of proton-proton collisions at the Large Hadron Collider (LHC) project represents the real challenge for processing and storage. A huge increase in data rate expected in the High Luminosity phase of the project requires more efficient real-time analysis methods that will enable a fast and accurate selection of events of interest from the enormous background production. Machine learning methods have been used in high energy physics successfully for different ranges of tasks. Quantized neural networks together with specialized library *hls4ml* enable the deployment of neural network models in Field Programmable Gate Arrays (FPGAs). Input quantization can, even more, reduce the model size while maintaining accuracy. A model with saturated data quantized with 2 bit retains accuracy higher than 90% representing a possible mechanism for real-time signal/background classification.

Key words: LHC, CMS, neural network, quantization, classification

1. Introduction

The Large Hadron Collider (LHC) is one of the largest international scientific projects. It has been organized by CERN (Conseil Européen pour la Recherche Nucléaire) as a result of the collaboration of over 10,000 scientists and engineers from more than 100 countries. LHC is the world's largest particle accelerator, built to test different predictions of elementary particle physics. The existence of the Higgs boson, as proposed within the Standard Model, was confirmed by LHC experiments which resulted in the 2013 Nobel Prize in Physics [1].

On the LHC ring, four detectors surround collision points and record data produced from proton collisions occurring every 25 ns. As a result of the collision, new unstable particles are formed and they rapidly transform into a cascade of lighter, more stable particles. Decay products passing through detector layers interact with them which enables the exploitation of different properties of particles. The extremely large amount of data is generated, tens of terabytes per second, also containing the vast majority of

uninteresting data or pile up (PU) that should be discarded. An event processing system – trigger, decides which events should be kept for further analysis and which ones discarded.

In the Compact Muon Solenoid (CMS) detector, the selection is accomplished using two level trigger system, a Level-1 trigger (L1T), and a high level trigger (HLT). The L1 trigger is a real-time trigger, making a decision within a few microseconds reduces the event rate from 40 MHz to 100 kHz. It uses custom hardware with Application-Specific Integrated Circuits (ASICs) and Field Programmable Gate Arrays (FPGAs), with typical latency of $O(1) \mu\text{s}$. Based on information coming from different detector layers (Figure 1), signals of interest are selected among the enormous background production. Interesting data selected by low-level triggers are passed on to higher-level triggers, implemented on large computer farms. Here, data from all parts of the detector are collected and synchronized, carrying out a further reduction from 100 to 1kHz [2].

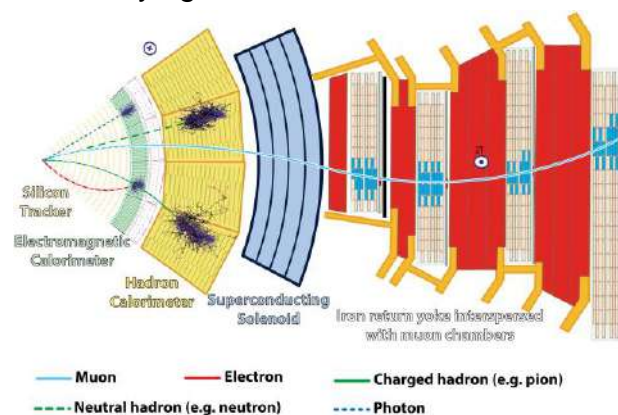


Figure 1 CMS detector layers [3]

In order to increase the potential for discoveries, LHC is preparing for a major upgrade, High Luminosity Large Hadron Collider (HL-LHC) is planned to start operation at the end of 2027 [4]. The luminosity (proportional to the number of collisions that occur in a given amount of time) will be increased by a factor of five compared to the current system architecture. The technology used in the previous phases cannot keep up with the expected increase in detector load and has suffered a certain level of damage from the original experiment. Therefore, the HL-LHC requires more advanced detectors to ensure high measurement accuracy. One of the most important upgrades for HL-LHC is the High Granularity Calorimeter (HGCAL), capable of dealing with expected rates of particles and high radiation. HGCAL can be considered as an imaging device, capable of delivering 3D “images”. L1T generates 2D clusters in each layer using nearest neighbors clustering and associates them in 3D clusters – multiclusters. We developed the initial version of the method to reduce the signal vs background classification complexity using a neural network model so it is possible to implement it in L1T hardware.

2. Related work

Machine learning (ML) methods, especially deep learning, have been used in a wide range of applications at the LHC [5]–[9]. Andrews et al. [10] used Convolutional Neural Network (CNN) to discriminate quark versus gluon-initiated jets using the simulated CMS Open Data.

Renner et al [11] used deep learning techniques to reject background events in the search for neutrinoless double beta decay and Ju et al. [12] applied Graph Neural Networks (GNN) for particle reconstruction. Classical ML methods due to their complexity and latency are not suitable for use in L1T for the identification of background signals. Therefore, new approaches have been introduced to use ML methods in real-time event processing.

One of them, used in this study, is neural network quantization, the process of approximating a neural network floating-point weights and biases with a low bit width format. The result is a dramatically reduced neural network model with a lower computational cost which then facilitates the deployment of deep neural networks on edge devices, like FPGAs used in L1T. QKeras [13] is an extension of the Keras library allowing for the creation of heterogeneously quantized versions of deep neural network models. With QKeras it is possible to do independent quantization of trainable parameters. It provides a set of quantizers, enabling mantissa quantization, exponent quantization, and binary and ternary quantization. Together with the hls4ml [14] Python package, enables fully automated deployment of models on FPGA hardware, like it is shown in [15], [16], [17]. In [16] authors have shown that using quantization and hls4ml, resource consumption can be reduced by a factor of 50, with nanosecond inference.

3. Case study: Signal vs background classification

When the detector records particle collision events, a huge number of unwanted extra collisions is also recorded, hiding the rare interesting collisions. Electromagnetic (EM) showers are produced by electrons and photons and represent the process of interest - signal, which appears at a lower rate than PU.

Dataset

Dataset is created based on data obtained from CMS data processing framework, CMS Software components (CMSSW). In this study, we will consider just interaction points in the Electromagnetic Calorimeter (ECAL) layers of the detector. The point in the cluster with the highest transversal energy will represent the multicluster barycenter. Afterward, the straight line through the detector center and multicluster barycenter (Figure 2). Intersection with each layer will represent the center of the squared region of interest (ROI) layer window $6 \times 6 \text{ cm}^2$ size (as a result of 3×3 bins, with bin size $2 \times 2 \text{ cm}^2$, which corresponds to a trigger cell) (Figure 3). Pixel values correspond to trigger cell energies in detector layers.

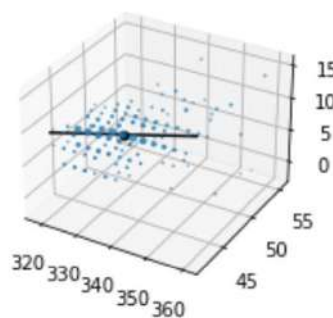


Figure 2 3D multicluster sample. Blue dots represent interaction points with ECAL layers; the black one is a barycentre with a line connecting the detector center

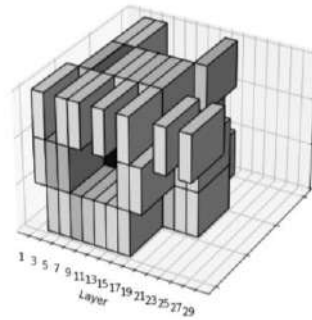


Figure 3 Generated multicluster layer image, a pixel value is proportional to the energy deposited in ECAL layer in selected ROI

Following the described images recipe, a dataset of ECAL images is created using dataset electrons $p_T=[2,200]$ GeV with PU for electromagnetic showers (EM), while images created using dataset minibias PU=200 represent background images (PU).

The training and validation dataset contains 10000 images (5000 EM + 5000 PU), and for testing purposes, there are another 1000 images (500 EM + 500 PU). Thus in total, the dataset contains 11000 images.

Classification model

The classification model used in the study is a fully connected homogeneously quantized network with 3 layers. QKeras offers a wide list of different quantizers, and in this experiment, the quantizer *quantized_bits* have been used for both weights and biases and the activation quantizer was *quantized_relu*.

Chosen quantizers and their parameters are described as follows:

1. *quantized_bits*(bits, integer, symmetric, keep_negative, alpha, use_stochastic_rounding)

Mantissa quantization was performed using the equation:

$$2^{int-b+1} \text{clip}(\text{round}(x * 2^{b-int-1}), -2^{b-1}, 2^{b-1} - 1) \quad (1)$$

Where x is input, b is a number of bits for the quantization and int number of bits that are to the left of the decimal point.

2. *quantized_relu*(bits, integer, use_sigmoid, negative_slope)

Analysis has shown that number of nodes in the network can be reduced to 16-10-8 (Figure 4) without a significant drop in the accuracy compared with the 32-32-32 model. In order to maximally reduce the model size, aggressive quantization should be used. Tests were also done with different quantizer settings and it was shown that weights and biases quantized on 2 bits using a quantizer with *quantized_bits* (2,0,0, alpha=1) setting maintains high classification accuracy despite low bit number. Activations are quantized on 2 bits as well, and *softmax* was used in the last layer as an activation function.

Model is trained in 64 epochs, with batch size 32, Binary Cross-entropy loss function, and Adam optimizer.

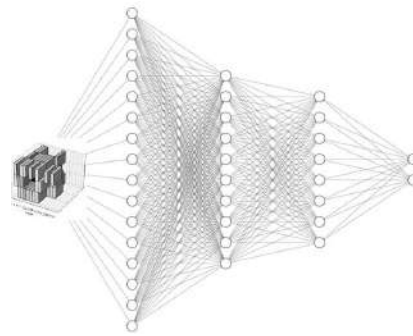


Figure 4 Fully connected neural network with 3 hidden layers (16-10-8)

Classification performance

Results of classification will be evaluated using standard metrics: accuracy (acc), precision (prec), recall (rec), F1-score (f1), Area Under the Curve (AUC), false negative rate (fnr) and false positive rate (fpr).

A model was first tested with full precision data. The training curve for that case is presented in Figure 5 and the results are shown in Table 1.

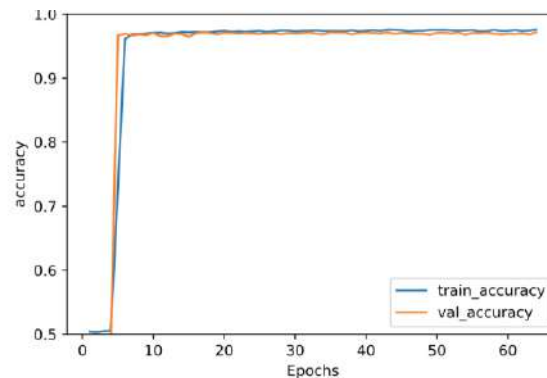


Figure 5 Training and validation accuracy for a model with full precision data

Table 1 Model accuracy for full precision data

acc	prec	rec	f1	AUC	fpr	fnr
0.965	0.994	0.936	0.964	0.969	0.006	0.064

After having trained and tested the network, the next step was to reduce input data size.

The simple quantization was applied with the next steps:

1. Data is normalized using linear scaling.
2. Normalized data were multiplied by $2^n - 1$, where n is chosen as a number of quantized bit.
3. Data was rounded to the nearest integer.

Dataset was quantized with 6,5,4,3 and 2 bits. A comparison of the EM cluster layer image quantized with 4 and 2 bits is shown in Figure 6.

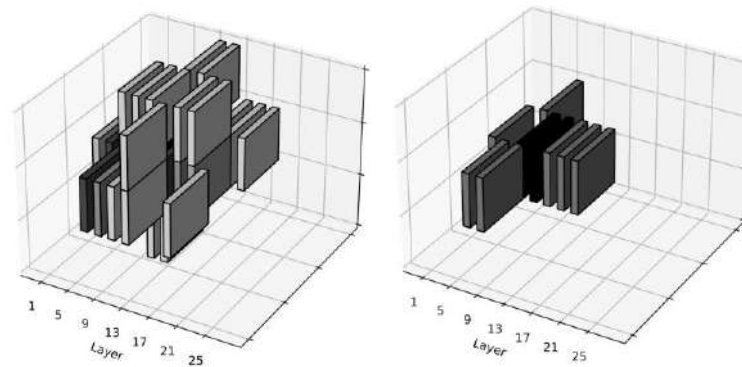


Figure 6 EM layer image, darker color indicates a higher energy deposit; a) image sample from dataset quantized on 4 bits b) image sample from dataset quantized on 2 bits

Results for quantization levels 6 and 5 are quite similar, and then slowly start to drop. As is already mentioned, the final goal is aggressive quantization (2 bits), with minimal loss of accuracy. As it is shown in Table 2 and Figure 7, there is a significant drop in accuracy for 2 bit data quantization.

Table 2 Model accuracy for quantized data

Bits num.	acc	prec	rec	f1	AUC	fpr	fnr
6	0.957	0.977	0.936	0.956	0.967	0.022	0.064
5	0.964	0.996	0.932	0.963	0.967	0.004	0.068
4	0.949	0.987	0.910	0.947	0.954	0.012	0.090
3	0.924	0.993	0.854	0.918	0.928	0.006	0.146
2	0.869	0.995	0.742	0.850	0.871	0.005	0.258

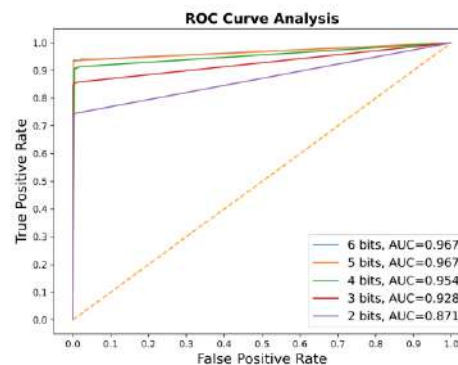


Figure 7 ROC curve comparison for models with different input quantization

5-bit and 6-bit quantization models show similar results, while models quantized under 4 bit give significantly worse results in all metrics.

In the next experiment, data saturation was used as a pre-step for quantization. Quantizer applied on saturated data can be considered as a non-linear quantization method. The same quantization levels are tested again. The saturation value is 10. Results are shown in Table 3 and Figure 8. Saturation preserves accuracy compared with non-saturated models. 2-bits quantization again shows a higher accuracy drop, but having AUC > 90% even that model can be acceptable.

Table 3 Model accuracy for saturated quantized data

Bits num.	acc	prec	rec	f1	AUC	fpr	fnr
6	0.952	0.973	0.930	0.951	0.962	0.026	0.070
5	0.958	0.987	0.928	0.957	0.968	0.012	0.072
4	0.960	0.985	0.934	0.959	0.967	0.014	0.066
3	0.943	0.993	0.892	0.940	0.949	0.006	0.108
2	0.915	0.986	0.842	0.908	0.917	0.012	0.158

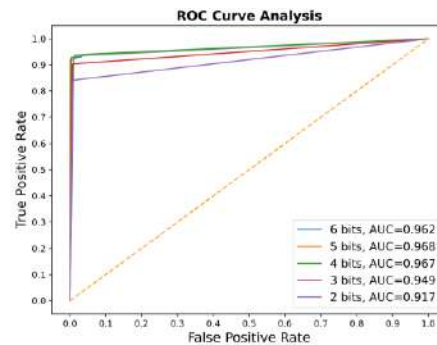


Figure 8 ROC curve comparison for models with different quantization for saturated input

Models quantized with lower bit number (4,3 and 2) shows better results compared with models trained with non-saturated data.

4. Conclusion and future work

It has been shown that by quantizing an input, model performances are quite well preserved. For a higher number of bits (5 or 6), performances are comparable with those obtained from full precision inputs. The saturation step allows quantization on a lower number of bits, keeping accuracy above 90%. Aggressively quantized neural network together with quantized input reduces the classification model and at the same time maintains accuracy. 2-bits data quantization, previously saturated, represents the candidate for real-time classification in L1T. The number of parameters is the same in all models, and Python doesn't allow specification of precision for saved data so the model file sizes are the same for models. But a low bit usage provides savings in performing computational operations. Therefore, the next step would be to test models on hls4ml to verify resource consumption and latency.

One of the limitations of the study is image covering of just ECAL layers. Also, idealistic images showing just one EM shower or PU don't correspond to a real detector situation, where many showers are generated at the same time, with the possibility of overlapping.

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SCIENTIFIC PAPERS

INTERNATIONALISATION OF UNIVERSITIES AND SDG 4: A FOCUS ON RESEARCH AND OUTREACH

Kyria Rebeca Finardi
Ufes, Vitoria, Brazil
kyria.finardi@gmail.com

Ramon Andres Ortiz Rojo
Ufes, Vitoria, Brazil
ramonandres.31@gmail.com

Abstract. This study reflects on the interface between internationalisation of higher education and global citizenship education (GCE) focusing on the United Nations Sustainable Development Goal (SDG) 4 – Quality Education – which aims to guarantee inclusive, equitable and quality education for all. GCE is related to SDG4 as it acknowledges interrelationships of the global, national and local aspects of higher education. So as to reflect about these interrelations, the present study reports on an outreach project¹¹ whose aim was to link research results through an outreach project from UFES to develop the internationalisation of small companies in the State of Espirito Santo, Brazil, in connection with another project at University of Valencia, Spain. This paper reports on a meta-analysis of a corpus of 20 studies produced at UFES and the needs analysis carried at the University of Valencia (UV) to illustrate the interconnections between innovation, internationalisation and GCE in relation to SDGs 4. The internationalisation of UFES was analysed in relation to the university's triple mission of offering research, outreach and teaching activities/opportunities. The results of the meta-analysis suggest that the internationalisation of UFES is related to its triple mission of offering teaching actions (analysed in the Business Administration course of UFES and UV), research (analysed in papers produced at UFES) and outreach (analysed in relation to the outreach/internationalisation project at UFES and UV). The analyses of preliminary findings of the projects at UFES and UV suggest that the process of internationalisation of the university is related to the SDG4 which in turn is related to the promotion of innovation of the curriculum fostering GCE.

Key words: Internationalisation, innovation, global citizenship education, SDG 4.

1. Introduction

The United Nations (UN) Sustainable Development Goal (SDG) number 4 – Quality Education – aims to ensure inclusive, equitable and quality education to promote lifelong learning opportunities for all. This objective is related to training and education for global citizenship (GCS), whose origin dates back to the 1980s, when the UN Commission on Sustainability and Development defined sustainable development as

¹¹ We would like to thank Fapes for financing the Project *Internacionalizando a Extensão e Estendendo a Internacionalização / Internationalizing Outreach and outreaching internationalization/* through Call Fapes Universal 03/2021 which in turn was linked to the project YES3D: Youth Entrepreneurship for Society from University of Valencia, financed by Generalitat Valenciana.

that which considers the resources necessary for future generations in terms of economic growth, social inclusion, governance and sustainability.

In 2015, the UN approved the 17 sustainable development goals (SDGs) that were included in the 2030 agenda. The United Nations Educational, Scientific and Cultural Organization (UNESCO) defines GCE as a form of education which aims to empower students of all ages to take active roles in local and global contexts to build more peaceful, tolerant, inclusive and safe societies. Furthermore, and according to Cho and Mosselson (2018), GCE is a form of social justice oriented towards the transformation of the educational curriculum to foster more equity, diversity and inclusion (EDI) in education.

While we recognize the importance of thinking about GCE in local and global terms, we understand that local, national and global issues can best be approached from a global perspective (Marginson & Rhoades, 2002) despite criticism that has been raised at this term for universalising western concepts and elites (Piccin & Finardi, 2019) masking the responsibilities of everyone involved in this process, especially local and national governments. In so doing, we approach GCE as one of the goals of the internationalisation of higher education, defined as “the intentional process of integrating an international, intercultural or global dimension into the purpose, functions and delivery of post-secondary education, in order to enhance the quality of education and research for all students and staff, and to make a meaningful contribution to society” (De Wit et al., 2015).

Guimarães and Finardi (2021) understand that GCE can represent a Third Space for the promotion of an internationalisation process which is sensitive to local, national and global tensions/agendas, that is, for the promotion of a glonacal internationalisation that accounts for the responsibilities of individuals, governments, agencies, communities and universities in these processes and so we approach the internationalisation of higher education as a way of developing global citizens (Gacel-Ávila, 2005; Braskamp, 2008).

The internationalisation of higher education and GCE are related to the internationalisation of society as a whole and, of special interest to the project described here, to the internationalisation of small and medium-sized enterprises (SMEs). The implementation of new economic opening policies worldwide (Coelho & Junior, 2016), the greater access to the internet and the fall of barriers in communications and transport (Knight & Liesch, 2015, Meyer, 2017) have contributed to the internationalization of SMEs.

When thinking about the difficulties that companies have when facing the international arena, Leonidou (2004) states that SMEs are the ones that have the greatest difficulties to internationalize. Ortiz (2021) analysed the process of internationalisation of SMEs, grouping the factors that could affect this process into three constructs, namely: the company's capabilities, the manager's capabilities and the institutional environment. The extensive literature review offered by Ortiz (2021) shows 34 factors that affect the internationalisation of companies, among which we highlight in this study the public policies for the promotion and support of the internationalisation of SMEs - in which we can also consider the internationalisation of education in Brazil (Wassem & Ferreira, 2020) -, the capacity and innovative culture and the mastery of foreign languages

(Sevilla-Pavón & Finardi, 2021) to perform in the new market as they relate to ODS4 and GCE.

In this context, higher education institutions play a fundamental role in the internationalisation of higher education, in GCE in general and in the training of future entrepreneurs, in particular. In this sense, we propose a reflection on these processes based on evidence from two projects carried out at Federal University of Espirito Santo (UFES) in Brazil and the University of Valencia (UV), in Spain - in order to reflect on the relationship between the internationalisation of companies, the university and the UN SDG number 4.

2. YES3D - Youth Entrepreneurship for Society

The YES3D project aims to investigate the role of three-dimensional virtual reality in contexts of international virtual exchanges between geographically-dispersed university students of languages for specific purposes. These exchanges were framed within the training processes of future professionals in the business world and, more specifically, of social entrepreneurship based on the Sustainable Development Goals (SDGs) proposed by UNESCO (UNESCO, 2020, 2012).

According to Sevilla-Pavón and Finardi (2021), problem-based telecollaborative learning projects can contribute to overcome global barriers and meet the needs of 21st century learners as active citizens. This is especially relevant in the current and enduring pandemic scenario we live in, where the need for greater mobility of young people during their formative stage has been highlighted by the European Union in its 2020 Education and Training strategy plan and this is a great challenge, since currently the mobility rate barely reaches 5% in Spain where UV is located and less than 2% in Brazil where UFES is located.

In this context, virtual mobility in the form of virtual exchange, telecollaboration (Guth & Helm, 2010, Helm & Guth, 2016) or online intercultural exchange (O'Dowd, 2007) is a form of virtual mobility increasingly adopted by educators in Europe (O'Dowd, 2013) and in Brazil (Finardi & Guimarães, 2020) as an element that supplements the physical mobility of students, providing opportunities for interaction in a foreign language for students who are in geographically distant locations (O'Dowd, 2007).

Other potentially beneficial aspects of virtual exchange include fostering student autonomy (Fuchs, Hauck, 2010; Hughes, 2010), linguistic fluency and accuracy (Guth & Helm, 2010; Kinginger & Belz, 2005; O'Rourke, 2007; Ware & O'Dowd, 2008; Warschauer, 1996), intercultural communication skills online (Guth & Helm, 2010; Belz & Müller-Hartmann, 2003; O'Dowd & Ritter, 2006; Sevilla-Pavón, 2020, 2018; Sevilla-Pavón & Nicolaou, 2020, 2017; Vinagre, 2014), multimodal digital competence and new online skills (Sevilla-Pavón & Haba-Osca, 2017; Hauck, 2007; Guth & Helm, 2010; Oskoz, Gimeno-Sanz & Sevilla-Pavón, 2018), membership and active participation in communities of practice (Dooly & Sadler, 2013), the negotiation of meanings (Cantó, de Graaff, & Jauregi, 2014), student motivation (Jauregi, de Graaff, van den Bergh & Kríž, 2012; Cantó, Jauregi & van den Bergh, 2013; Jauregi et al., 2012), language teacher training and peer learning (O'Dowd, 2015; Cunningham, 2013; Dooly & Sadler, 2013; Guth & Helm, 2010; Ware & O'Dowd, 2008; Kohn & Warth, 2011; Brígido Corachán, 2008; Lewis, Chanier, & Youngs, 2011) critical thinking and analysis skills (Dooly, 2010; Furstenberg & Levet, 2010), among others.

The first iterative cycle of the project focused on examining the potentialities of telecollaboration based on ICT in the development of 21st century competences in English learners for Specific Purposes. The second iterative cycle, focused on the redesign of the project, based on the feedback received and which consisted in the improvement of tasks and telecollaborative learning environments of English for Specific Purposes in order to pay greater attention to the development of the affordances of the telecollaborative environment, while providing greater cognitive scaffolding of the tasks and tools used.

The specific objectives of the project are:

- to encourage the development of 21st century, linguistic and intercultural skills, from a cognitive point of view and through the creation and use of avatars in virtual exchanges in a three-dimensional virtual platform, taking into account the body-mind continuum that highlights the enactive paradigm;
- to carry out an analysis of the way in which virtual reality simulations around social entrepreneurship and virtual exchanges, applied in contexts of ESP, can supplement real professional situations and the preparation for such situations;
- to examine the possible emergence of a creation of a transnational community of practice;
- to explore the possible added value of the Spatial three-dimensional virtual platform in facilitating interpretation, study and work around facts, information, case studies, etc., effectively and conducive to collaborative and intercultural problem solving and identification and search for additional key information;
- to determine the effectiveness of the three-dimensional virtual platform Spatial in terms of facilitating and advancing research from different linguistic, (inter) cultural and professional perspectives.

To achieve these objectives, the activities developed within the framework of the project follow this schedule:

Phase 1: literature review in relation to the main axes of the project: consultation of the specialised bibliography in relation to virtual exchange, English for Specific Purposes, three-dimensional/immersive virtual reality, the SDGs and social entrepreneurship.

Search for specific information on key concepts in social entrepreneurship (reasons and impact of social entrepreneurship, risks and challenges of start-ups, idea communication strategies and how to reduce the risk of failure).

The Fapes Universal project carried out at UFES was inspired in and linked to the YES3D project. The literature review carried out at UFES as part of Phase 1 of the YES3D project will be discussed later on in this study.

Phase 2: needs analysis. This phase was described/reported in Sevilla-Pavón and Finardi (2021) and aimed to design and administration of a scale for measuring entrepreneurial competences in the university population to provide detailed information about the needs (linguistic, communicative and professional) of the academic community and, more specifically, of language students for specific purposes, in terms of social entrepreneurship.

As part of the second phase of the YES3D project, an initial questionnaire in the form of a needs analysis survey about entrepreneurship and linguistic services was

administered, and 31 responses were obtained from participants from the Universitat de València, in Spain and reported in Sevilla-Pavón and Finardi (2021).

Phase 3: creation of the three-dimensional virtual room in the Spatial environment for interaction in multinational groups by a company specialised in virtual reality.

Adaptation of the simulations of professional environments to the three-dimensional virtual platform with special attention to social problems and their relationship with the SDGs.

Phase 4: implementation of the first iterative cycle of YES3D with pilot groups: International Business students, Double Degree in Tourism and Business Administration and Management and Degree in Aerospace Engineering, which allows the testing of the virtual platform designed. Design of open learning objects related to social entrepreneurship, available to the university community through the creation of a repository.

Phase 5: carrying out training and dissemination activities and actions by specialists of recognised international prestige around the central axes of the project: virtual exchange, English for Specific Purposes, three-dimensional/immersive virtual reality, SDGs and social entrepreneurship.

Phase 6: analysis of the results and dissemination by means of academic articles and participation in conferences and academic events for the dissemination of the results. Global evaluation of the project with triangulation of both quantitative and qualitative data. Dissemination of the project and the open repository of learning objects on the project website.

3. Fapes Universal - Internationalizing Outreach and outreaching internationalization

The Fapes Universal project aimed to internationalize the outreach projects and to outreach the internationalisation actions of UFES in connection with the University of Valencia (UV) and linked to the YES3D project described above. It intended to create possibilities for exchanges and interactions mediated by technologies, languages and knowledge shared between UFES and UV with the Espirito Santo community, focusing on small and medium-sized exporting companies (SMEs) to promote a global education, sensitive to global/national/contexts in a post-Covid scenario. The project integrates teaching, research, outreach and internationalisation projects/actions of UFES and UV in the development of “glonacal” citizenship, acting in the exchange/transfer of knowledge, innovation and technology from UFES and UV to the Espirito Santo community, helping in the process of internationalisation of the knowledge of the SMEs and communities involved. In order to assess the role of UFES in the development of SDGs 4 as well as to understand the challenges that SMEs face in their internationalisation, in this article we describe a meta-analysis of 20 works produced at or about UFES (during phase 1 of the YES3D project and as part of the Fapes Universal project) that address the role of UFES in the internationalization of society, fostering GCE and the development of SDG4.

According to Finardi and Ortiz (2015), Administration Courses, responsible for training future managers or entrepreneurs, must pay attention to the need to train global citizens. In other words, Business Administration courses must be internationalized in order to help future managers and companies to tread the path of internationalisation.

However, Finardi and Ortiz (2015), in the analysis of the HEIs investigated by these authors, this is not what they found. This study points out that 75% of Brazilian higher education is composed of private HEIs and that these, in turn, have no interest in internationalizing because they are comfortable in their positions. The public ones, in smaller numbers, but much more expressive in the internationalisation scenario, have been seeking to internationalize, albeit in a biased way.

If we think about numbers, private HEIs hold the majority of Business Administration courses, which are generally low-cost and very popular, and hence the size of the gap we have: 75% of Brazilian HEIs are not interested in internationalizing, so most of managers who will work in the market in the near future do not receive the training that the market demands.

In fact, Ortiz Rojo et al. (2015), when analysing/comparing the Business Administration course at a public university and at a private one, concluded that despite the public university having more motivation for internationalisation, both had gaps in the internationalisation of the curriculum. None of the two universities investigated in this study contained themes, disciplines or internationalisation content in their curricula or English or foreign language courses in the curriculum.

4. Meta-analysis

A meta-analysis (Timulak, 2009, 2014) approach was used to analyse the role of the university (UFES) and the relationship between its internationalisation process and that of SMEs, in relation to SDG 4. The 20 works that make up the corpus were produced at and about UFES.

Table 1- Corpus of 20 works for Meta-analysis

N.	Tipo	Autor	Ano
1	Paper	Amorim and Finardi	2021
2	Thesis	Ortiz	2021
3	Paper	Finardi, El Kadri and Taquini	2021
4	Paper	Guimarães and Finardi	2021
5	Paper	Guimarães, Mendes and Hildeblando Júnior	2021
6	Paper	Guimarães, Finardi and Amorim	2021
7	Paper	Taquini and Finardi	2021
8	Paper	Finardi and Guimarães	2020
9	Paper	Finardi et al.	2020
10	Paper	Guimarães et al.	2020
11	Paper	Wassem and Ferreira	2020
12	Paper	Finardi, Guimarães and Mendes	2019
13	Paper	Finardi and Guimarães	2019
14	Paper	Guimarães and Finardi	2019
15	Paper	Guimarães et al.	2019
16	Paper	Piccin and Finardi	2019
17	Paper	Amorim and Finardi	2017
18	Paper	Finardi, Santos and Guimarães	2016
19	Paper	Ortiz Rojo et al.	2015
20	Paper	Finardi and Ortiz	2015

5. Results

Amorim and Finardi (2021). **Objective:** to present a matrix of institutional (self) assessment of internationalisation built from 86 indicators, distributed in the three

pillars of the university and analysed in relation to the categories of language policy, academic mobility and internationalisation at home (IaH) to suggest three classifications for the internationalisation of universities: internationalized, engaged and emerging. **Results:** the matrix represents a relevant contribution as a unified instrument for institutional evaluation. The piloting of the matrix at UFES suggests that this institution has an emerging internationalisation.

Ortiz (2021). **Objective:** to develop a conceptual model for classifying the level of internationalization of small and medium-sized enterprises. **Results:** the study contributes with a conceptual model for classifying the level of internationalisation of companies. In addition, it informs the factors that affect the internationalisation of companies, facilitating the formulation or adjustment of SME strategies for internationalisation.

Finardi, El Kadri and Taquini (2021). **Objective:** to reflect on the use of English as a language of instruction (EMI) from the perspective of 12 students of a postgraduate course in Biological Sciences enrolled in an academic writing course in English taught in 2019-2 at UFES. **Results:** EMI is seen as a possibility to improve English and academic literacy and lack of proficiency can compromise student participation/performance in EMI courses and internationalisation actions. The view of English is linked to the naturalisation of this language as an academic/international language, suggesting the need to think about the critical use of English in general and in EMI courses in particular.

Guimarães and Finardi (2021). **Objective:** to critically reflect on ECG alternatives as a glonacal Third Space. **Results:** ECG as a Third Space can promote global internationalisation by recognizing the role of individuals, governments, communities and universities in this process.

Guimarães, Mendes and Hildeblando Junior (2021). **Objective:** to reflect on the relationship between internationalisation and foreign languages (L2), according to the perceptions of students of the IsF program at UFES. **Results:** the idea of internationalisation is mainly linked to academic mobility and the need to learn L2 for internationalisation. The discussion suggests Internatinalisation at Home (IaH) strategies and reallocation of resources to L2 provision, to deal with misconceptions associated with internationalisation.

Guimarães, Finardi and Amorim (2021). **Objective:** to analyse the international cooperation relations between the Global North and the Global South after the pandemic. **Results:** the interruption of physical academic mobility brought several challenges, but also opportunities for internationalisation in the Global South. An example of an opportunity is the partnership between UFES and the University of Coventry, in England, consolidated through virtual collaboration during the pandemic.

Taquini and Finardi (2021). **Objective:** to analyse the role of foreign languages (L2) in the provision of courses in English (EMI Guide 2018-2019) and in the process of internationalisation at UFES. **Results:** English has a hegemonic role in relation to other L2 possibilities in the UFES internationalisation process.

Finardi and Guimarães (2020). **Objective:** reflect on the process of internationalisation of higher education in the Global South after the pandemic. **Results:** the pandemic brought many challenges, but also (and mainly) opportunities for the internationalisation process of higher education institutions in the Global South, as they

had to suspend academic mobility programs (for a few), replacing them with virtual mobility programs (for all) that expanded the range of partner countries, languages and universities to countries like Brazil, describing in particular the case of UFES in this process.

Finardi et al. (2020). **Objective:** reflect on the process of internationalisation of higher education, from a locus of enunciation from the Global South (UFES) and from the Global North (FAU) through the analysis of language policies and international agreements in these two institutions. **Results:** the analysis of UFES' language policies and international agreements suggests a reactive and colonial nature of this institution's internationalisation process, expressed in the number of agreements with institutions in the Global North and in the language policies that favor the use of English. Analysis of FAU's international cooperation agreements and language policies suggests that internationalisation strategies are largely designed based on the university's privileged position as an English-speaking institution located in the Global North.

Guimarães et al. (2020). **Objective:** to analyse the process of internationalisation of higher education in Brazil through the statements informed in the institutional missions of 62 federal universities. **Results:** there is a gap between the declared beliefs/missions/intentions and the actions of the analysed universities, among them, UFES.

Wassem and Ferreira (2020). **Objective:** to analyse how internationalisation appears in the institutional documents of UFES, focusing on concepts, reasons and strategies foreseen in the institutional policy for its implementation through a qualitative approach with document and content analysis according to Bardin (2004). **Results:** among the internationalisation actions is the creation of an International Relations Secretariat (SRI), of the Espírito Santo Education Internationalisation Network (RIEES), as well as the elaboration of a joint project, with the involvement of nine PPGs of the institution, in the CAPES Institutional Internationalisation Program (PrInt), demonstrating an articulated effort of work of its professors and programs but also the existence of contradictions in the process of planning actions for internationalisation, considering the diversity and specificity of the programs and the political and economic context Brazilian.

Finardi, Guimarães and Mendes (2019). **Objective:** to think about the internationalisation of Brazilian higher education institutions more critically. **Results:** gap (and incompatibility) between principles and policies to critically guide the internationalisation process in Brazil, suggesting the need to deconstruct the hierarchical imaginary of intellectual and cultural domination and solidary interaction between institutions in peripheral countries to strengthen the public good of education higher.

Finardi and Guimarães (2019). **Objective:** to discuss the concept of agency in relation to language policies at UFES. **Results:** top-down policies have a major impact on UFES, leaving little room for the exercise of local agency.

Guimarães and Finardi (2019). **Objective:** to discuss the interface between internationalisation and language policies in general in Brazil, seeking evidence and evidence at UFES through the analysis of the Science without Borders (CsF), Languages without Borders (IsF) and the Capes PrInt Public Notice. **Results:** UFES'

language and internationalisation policies are related and aligned to national policies, having been reactively induced by them.

Guimarães et al. (2019). **Objective:** to explore the concept, possible benefits and challenges of internationalisation at home (IaH) in general in Brazil and at UFES in particular. **Results:** the study suggests that approaches such as COIL (Collaborative Online International Learning) and AI (intercomprehension approach) are relevant alternatives for the development of IeC with multilingual possibilities in this context.

Piccin and Finardi (2019). **Objective:** to question the concept of GCE from a decolonial perspective in the context of internationalisation. **Results:** suggestion of alternative approaches and creation of post-colonial learning spaces.

Amorim and Finardi (2017). **Objective:** to evaluate internationalisation in Brazil with data collection at UFES, at three levels, namely: macro (national), meso (institutional/UFES) and micro (academic community/UFES).

Results: it was concluded that internationalisation actions at the macro level affect and are affected by globalisation, given the implementation of large federal programs such as Science without Borders and Languages without Borders; at the meso level, the analysis suggests that UFES aims at internationalisation but its actions demonstrate incipient engagement; and finally, at the micro level, the academic community of UFES is interested, but is not yet fully engaged in the actions proposed by the IES. Overall, the study concluded that foreign languages and English in particular play a relevant role in internationalisation, but actions and policies are disjointed at various levels.

Finardi, Santos and Guimarães (2016). **Objective:** to discuss the role and relationship between globalisation and foreign languages in the process of internationalisation of higher education, describing the creation of the International Literacy Coordination within the structure of the UFES International Relations Department. **Results:** the creation of a language coordination within the structure of the Secretariat of International Relations is evidence of the role of foreign languages in the internationalisation process at this institution.

Ortiz Rojo et al. (2015). **Objective:** to investigate how Business Administration undergraduate Courses encourage the acquisition of social capital by their students to face the globalised market. **Results:** The investigated HEIs should better explore aspects such as ICTs, the English language and activities beyond the classroom. The main way to foster social capital in HEIs continues to be the face-to-face class. Furthermore, the topic of globalisation is not part of the Courses curriculum and its inclusion depends on the teacher. The majority (68%) of students do not feel prepared to face the globalised market.

Finardi and Ortiz (2015). **Objective:** to reflect on the connection between globalisation, the internationalisation of universities and the construction of social capital in emerging countries. **Results:** one of the biggest challenges in building social capital in higher education in Brazil is related to the lack of proficiency in English to help in the process of internationalisation of higher education, with the consequent greater inclusion of emerging countries and their universities in global conversations.

6. Discussion

The analysis of studies on the internationalisation process of UFES suggests that this process is closely related to the university's triple mission of offering teaching, research and outreach actions. The internationalisation of UFES is related to its teaching mission in general and in particular to the Business Administration course as reported in Finardi and Ortiz (2015). One of the deficiencies found in this study is related to the lack of offer, incentive or inclusion of foreign languages in general or English for general or specific purposes in the curriculum of the Administration course at UFES and this is an area in which the teaching at UFES can improve with the example set by the UV.

The aforementioned deficiencies are directly related to the perceptions of future managers, as reported in Ortiz Rojo et al. (2015) once most of the students participating in the study (68%) did not feel prepared to face the globalized market.

In this sense, when dealing with future managers or administrators, a global approach is called for (Marginson & Rhoades, 2002). It is worth mentioning the three factors that affect the internationalisation of companies highlighted by that Ortiz (2021) namely: public policies to encourage and support the internationalisation of SMEs and mastery of foreign languages (English) for the performance in the new market.

Regarding public policies, we believe it is interesting to consider those related to the internationalisation of higher education in Brazil (for example, Wassem, Pereira & Finardi, 2020). Regarding the culture of innovation, which must exist in SMEs when it comes to strategies for internationalisation, it is estimated that this question should be part of a training that aims to prepare citizens (future managers) with a global sense, that was not identified in the HEIs investigated by Finardi and Ortiz (2015) and Ortiz Rojo et al. (2015). Regarding the teaching of English in Business Administration Courses, it is observed that there is still much to be done at UFES (Finardi, El Kadri & Taquini, 2021) and projects such as YES3D and Fapes Universal aim to contribute in that improvement.

Regarding research, the analysis of the corpus shows that there is a strong relationship between the internationalisation process and research at the investigated HEI, probably encouraged by national public notices with an inductive nature focused on graduate studies, as is the case of Capes PrInt. Finally, in relation to extension, the analysis of the corpus did not allow us to glimpse a close relationship between the internationalisation process and outreach, but the outreach project described at UFES represents a hope in this sense.

If we analyse the internationalisation of the HEI investigated in relation to this triple mission, we can see how the lack of incentive for the internationalisation of education can affect, in the case of the Administration course, the internationalisation of SMEs, since the university is responsible for the formation of these future managers.

Finardi and Ortiz (2015) point out that $\frac{3}{4}$ of the Brazilian higher education institutions (HEIs) that offer most Business Administration courses in the country are private and do not have much motivation to internationalize since the domestic market for private HEIs is relatively low, comfortable considering the total supply and demand in the country. Thus, private HEIs do not need to seek tuition from foreign students to maintain themselves.

By triangulating the presented theoretical framework, SDG 4 and the results of the 20 studies listed in the meta-analysis, we can trace some more points of intersection. With

regard to the internationalisation of UFES, for example, we observed that the university is moving towards internationalisation, however, this process is still emerging (Amorim & Finardi, 2021) and lacking in articulations at the national, institutional and individual levels (Amorim & Finardi, 2017) and with regard to broader and more inclusive language policies both for the improvement of English, the most prominent language in the internationalisation process, and for the inclusion of other languages in the training of professors and students at the university, we see that there are still gaps for the development of SDG4 (Finardi, Santos & Guimarães, 2016; Finardi & Guimarães, 2019; Guimarães & Finardi, 2019; Finardi, El Kadri & Taquini, 2021; Taquini & Finardi, 2021).

Therefore, relating these studies with the theoretical framework and the UN SDG 4, we realized that, despite the engagement of UFES and example set by UV (Sevilla-Pavón & Finardi, 2021), not least in relation to internationalisation of higher education and the role of language training (in the case of YES3D, English for specific purposes), observed mainly in relation to the research mission of UFES, the development of teaching and outreach projects and concrete actions for global citizenship education is still in lack of investment there.

Signalling this gap, the studies by Piccin and Finardi (2019), Finardi, Guimarães and Mendes (2019), Guimarães et al. (2019), Finardi et al. (2020), Guimarães et al. (2020), Finardi and Guimarães (2020), Guimarães and Finardi (2021), Guimarães, Mendes and Hildeblando Júnior (2021) and Guimarães, Finardi and Amorim (2021) call for a more critical and partnership-oriented internationalisation process, whether for research or academic mobility, more symmetrical, even given the post-pandemic context. This approach points to a more inclusive and equitable institutional internationalisation, as Joseph (2011) suggests the internationalisation of the curriculum with a transformative approach. Thus, we realize that, more recently, UFES has made efforts (Wassem & Ferrereira, 2020), albeit in short steps, to achieve UN SDG 4, given the outreach project described.

7. Conclusions

We believe that for the university to contribute to the internationalisation of SMEs and the development of SDG 4 in relation to a global citizenship education, there must be greater investment in the internationalisation of education, with transformative approaches and actions (Joseph, 2011), just like the outreach project that aims to connect the university with society. In this way, both work together for sustainable development and for a more inclusive and equitable quality education, in line with SDG 4. It is known that foreign languages, with English gaining a prominent place, are still in need of investment to drive a global citizenship, that is, in the formation for global, national and local understanding. If we realize that there is a gap in the training of future managers of SMEs, students of Administration courses, for example, regarding the foreign language for internationalisation, the internationalisation at home appears as an efficient alternative to remedy this bottleneck.

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STUDENTS' PERCEPTIONS OF TESTING IN SECOND LANGUAGE ACQUISITION: WHAT DO WE WANT TO TEST? WHAT DO THEY PERCEIVE?

María Pilar Alberola Colomar

Florida Universitaria, Catarroja, Spain
palberol@florida-uni.es

Raquel Iranzo Fons

Florida Universitaria, Catarroja, Spain
riranzo@florida-uni.es

Abstract. There are many alternatives to testing in order to assess students' performance, but in actual fact, students still have to take a wide amount of tests throughout their language training.

Years of teaching experience in further education at Florida Universitaria (affiliated to the University of Valencia, Spain) have proved the important gap existing between what teachers want to test and what students perceive, frequently ending in frustration on both sides. After analysing the possible causes for the lack of understanding between both parties, we decided to carry out an experience based on peer testing across two educational levels.

The aim of this paper is twofold, presenting the peer testing experience, and explaining what us, as teachers and testers, have learnt from our students about their perceptions.

The three main stakeholders of the experience are: a group of 3rd-year students in the Degree in Primary Education (major in English) who designed a language test for a group of Vocational Training learners (in the finance field), and the English teachers of both groups who coordinated the whole process.

First, the Education students (testers) were trained in basic concepts about exam design techniques. Afterwards, they met the Vocational Training students (testees) to find out about their skills, English level and have a first personal contact. Then, testers designed an exam based on the communicative learning approach, including the contents studied by testees in their A2-B1 English course. Finally, testers administered and marked the exercises. Results obtained accounted for a percentage of the Finance students' English assessment. As regards the Finance participants, they actively played a part providing feedback related to their perceptions of the test and the procedure.

The experience was highly satisfactory for all the parties. On the one hand, testers and testees were able to engage in the testing system as active actors and understand its objectives and difficulties from within the process. Students' ratings in the satisfaction questionnaire confirmed that this activity was remarkably motivating for them. On the other hand, the English lecturers became aware of their students' testing perspective, and the need to create real settings where learners could apply their theoretical knowledge. All in all, the experience has had a positive washback effect on the English subject and subsequent tests.

Key words: *peer testing, motivation, students' perceptions, real settings, further education.*

1. Introduction

Undoubtedly, "testing is an important part of every teaching and learning experience" as Madsen (1983: 3) claims, but there are many alternatives to testing if we need to

assess students' performance in second language acquisition. According to Brown & Abeywickrama (2019: 5), testing can be considered a subset of assessment but not the only form. In actual fact, students still have to take a wide number of tests throughout their language training, because there is no denying that tests provide a standard in order to make comparisons among students as Hughes (2003: 4) states.

Years of teaching in further education at Florida Universitaria (affiliated to the University of Valencia, Spain) have proved the important gap existing between what teachers want to test and what students perceive, frequently ending in frustration on both sides. After analysing the possible causes for the lack of understanding between both parties, we decided to carry out an experience based on peer testing across two schooling levels. The first project took place in 2017, and since then this testing process has been organised every academic year with different students but in the same academic levels, altogether six editions. Along these years many aspects have been modified, especially those related to communication tools among participants and test administration (online or face-to-face). Although this is an ongoing experience that will need to be adapted to the necessities of each year's students, this article is based on the last edition, because it includes all the modifications that have been necessary to improve the initial idea.

The aim of this paper is twofold, presenting the classroom-based peer testing experience, and explaining what us, as teachers and testers, have learnt from our students about their perceptions on being tested.

In addition to the above-mentioned aims, there are some objectives which are specific to the project we are explaining, namely: to increase students' motivation to learn English as a second language, to enhance the use of computing tools in education as well as students' responsibility when dealing with peers, to encourage possibilities of cooperation across different educational levels and to improve students' grammar and communication skills. On top of that, we also target to find a way to help students get involved in their own assessment as practitioners, but from two different perspectives, as test designers and as test takers.

In the present study, first testing will be addressed from two viewpoints, namely teachers' main reasons for classroom-based testing and students' perceptions of being tested. Additionally, motivation will be approached as a consequence of strengthening testees' positive feelings towards exams. Then, the peer testing experience across levels will be described and results will be presented. To finish, conclusions and further actions to be taken will be outlined.

2. Testing from two different viewpoints

Tests exert a powerful influence on learners and learning but it is not always seen as beneficial. As Alberola (1998) explains, to some researchers testing is a negative ingredient of the teaching process, and to others, testing is a conservative restraint on development.

In fact, there are also language teachers who do not find tests nor testers reliable. Hughes (2003: 1) admits that a great deal of language testing is of very poor quality. Frequently, tests may have a harmful effect on teaching and learning and even fail to measure accurately what they are intended to measure. Nevertheless, this author also

remarks that information about people's language ability is often very useful and sometimes necessary (Hughes, 2003: 4).

From a more positive perspective, other researchers view tests as a type of measurement. Tests are also used as a source of information for making decisions in the teaching-learning process. Bachman (1990: 78) considers that the amount and type of testing that is done depends on the decisions that need to be made about individuals and programs. Furthermore, tests permit teachers to focus more carefully on the specific language abilities they are interested in. They can be considered an instrument that completes other methods of measurement and indicators of abilities or attributes that are of interest in research on language, language acquisition and language teaching. But it should be pointed out that, tests can also act as tools to reinforce learning and to motivate students.

When the focus is on class-based testing, it is important to highlight that the teacher knows and interacts with each learner, and the purpose is to assess the current abilities of the student to plan further learning steps. In traditional terminology, this makes classroom assessment formative, rather than summative as Fulcher and Davison (2007: 27) stress. These authors also add that "classroom assessment is completely integrated with the class activities since it is a social learning environment that encourages interaction, communication, achieving shared goals and providing feedback from learner to learner as well as teacher to learner" (2007: 29). However, even in this situation, as far as students' perceptions are concerned, tests can provoke feelings of anxiety and negative emotions, such as the fear of failure and yet they feel unavoidable, as explained by Brown & Abeywickrama (2019: 1). We cannot forget that emotions and their study are crucial in the teaching-learning process as Elizondo Moreno et al. (2018) recall.

Two further considerations as regards students' perceptions about testing are pointed out by Struyven et al. (2005). On the one hand, students' perceptions about evaluation methods also play a significant role. On the other, students' preferences of assessment do not match their perceptions about the 'appropriateness' of evaluation. As a conclusion, research carried out by these scholars evidenced that students' perceptions about assessment and their approaches to learning are strongly related. The perceived characteristics of assessment seem to have a considerable impact on students' approaches and vice versa.

3. Testing as a motivational tool

Previous editions of the peer testing experience evidence three factors which increase participants' motivation: the fact that the project is relevant to real life situation in the teaching-learning context, it has teamwork as a basic work methodology, and students learn with peers (Alberola & Iranzo, 2018). Our project confirms in the practice what researchers have claimed for years about these motivational elements.

Concerning "being relevant to real life", in the present project there are two perspectives depending on the students' role. From the Education students' standpoint (testers), who will become teachers in one year, it is pertinent the idea that Williams & Williams (2011) detail, the first factor to increase students' motivation is making the content "relevant to real life" which is particularly important to students' careers. In fact, we are linking "motivation" with "transfer", following the terminology used by Ngeow

(1998), students feel motivated because they understand that the learning process is relevant and transferable to other situations. In this experience the Education students can see how the testing process they have worked on, can be transferred to their future primary school classes. For the Finance students' role (testees) the real-life context is in the exam itself, as Bachman (2002: 471) clarifies, a fundamental aim of most language performance assessments is to present test takers with tasks that correspond to tasks in 'real-world' settings, and that will engage test takers in language use.

The second motivational element is "teamwork". It is accepted that it can contribute to learning (Williams & Williams, 2011), but lecturers should be aware of the influence among team members, which is not always positive. As Dörnyei (2001) mentions, the motivation of the participants is not independent of each other. When a student works with highly motivated or unmotivated partners, this affects the learner's own attitude towards the task. Despite the many issues that can have a negative impact on collaborative work, researchers confirm that there are more advantages than drawbacks.

In connection with the third factor, "learning with peers", Colvin (2007) affirms that peer teaching can also contribute to students' learning, motivation, and empowerment. Apart from its motivational impact, our project was geared towards peer teaching to benefit from other advantages highlighted by some scholars. Briggs (2013) states that peer teaching enables direct interaction between students that promotes active learning, peer teachers also reinforce their own learning by instructing others; besides, students feel more comfortable and open when interacting with a peer. Furthermore, peers and students share a similar discourse, allowing for greater understanding. Giving feedback has been a relevant aspect in the project we are presenting, testers had to give testees information about their responses and testees had to comment on testers' exam design and procedure. Falchikow (2001) emphasizes the importance of giving peer feedback after testing, since students engage in reflective criticism of the performance of other students using previously identified criteria. Falchikow (2001) also stresses that to communicate critical feedback to their peers, students need to develop diplomatic and constructive ways of doing it.

To add a fourth factor closely related to the experience here presented, we strongly believe that making students participate in their assessment process will help them understand it and see how testing can reinforce their learning. Hence, it will act as a motivation booster.

4. Describing the experience

The experience described in this paper is based on peer testing in two groups: third-year students in the Degree in Primary Education (major in English) who designed a language test for a group of Vocational Training learners (in the finance field).

Tight collaboration among the different stakeholders (teachers and students) was necessary to obtain the desired outcome. On the one hand, the two English lecturers of both groups worked together to coordinate the process and to set objectives, tasks, deadlines, guidelines, and assessment. On the other hand, students collaborated with their own classmates and with the participants from the other academic level, which makes the experience special.

With regard to the process, throughout a month, the Education students (testers) were trained on the essential exam design techniques. Once they had gained theoretical knowledge about testing, a practical application was necessary and at this stage the collaboration between students in both educational levels (Vocational Training in Finance and Degree in Primary Education) started. They met for one hour and the Education students (testers) were able to find out about testees' language skills, and have a first personal contact.

In order to establish a testing process, the different steps suggested by Brown & Abeywickrama (2019: 57) were followed: the purpose of the proposed test was analysed, the specific abilities to be assessed were stated, test specifications were created, a variety of items (test methods) were designed, the classroom test was administered, and a rationale for scoring, grading, and giving feedback was constructed.

During the first term, the Finance students in their A2-B1 English course had been working in groups on some grammar points, and business-related vocabulary based on topics such as: office orientation, office routines, using voicemails and the intranet, handling mails and using a courier service. These would become the main language aspects to be tested so that the Finance students could show their level of content acquisition by completing the test designed by the Education students. The test should contain a representative sample of the course and a close relationship with the course objectives because, as Read (1990) recommends, the topic of the test should be related to a subject that all the testees have enough relevant information about, to be able to show the best of their ability.

Despite the fact that the general approach to the test design should ideally be communicative, due to the lack of testing experience that the Education students had, the coordinators allowed them to use basically objective questions. That is, questions that "can be scored without requiring any judgement by the scorer as to whether an answer is correct or not", as defined by Read (2000: 75-76).

Thereafter, the 12 Education students worked in pairs and designed one test per pair, on the whole 6 tests. Each of the 27 Finance students participating had to complete individually two different tests, whose mark was the average score obtained in both exams to ensure more reliable results, according to the teachers conducting the experience. The lecturers were also in charge of establishing which testers had to work with which testees.

The Education students were assigned with the design of a test that had these core characteristics: one five-item activity per content point, using business specific vocabulary, additionally the activities had to be original and not copied from any source. Additionally, each type of activity had to be used only once to avoid the method effect. Pupura (2004: 112) exemplifies this effect by saying that some test takers perform better on multiple-choice tasks than on oral interview tasks; others do better on essays than on cloze exercises; and still others score better if asked to write a letter than if asked to interpret a graph. Each of these activities has a set of unique characteristics, and this author calls them test-task characteristics.

Together with the test, students had to create the marking method. One of the most difficult issues the Education students had to solve was how to weight test items. It is true that those subtests or items that are thought to be more important carry more

weight. Although Ory & Ryan (1993: 82) do not fully support differential weighting and from their point of view, it is more intuitive than practical. Alderson et al. (1995) agree with Ory & Ryan (1993) in the lack of benefits obtained by differential weighting of items or test components, regarding reliability and validity. After analysing both points of view, in the present project students were allowed to decide how they wanted to mark their test.

Once the test was finished, pretesting was fulfilled in class prior to the test administration to the Finance students. Since this test was not high-stake and there were no other testees to sample, it was impossible to follow the recommendations given by Alderson et al. (1995: 74-76) based on the idea that pretesting involves administering the test first to a group of testees which should be as similar as possible to the group of students for which it is really intended. Instead of a regular pretesting process, in the project here described all the exams were reviewed by other testers and the coordinators with the objective of checking test difficulty, language mistakes, format, structure, etc.

Finally, testers administered the tests. The Education students went to the Finance students' classroom, played the role of real teachers, distributed the copies to the assigned students and solved their problems during the test time. They acted autonomously although the two coordinators were also present to check that the protocol designed ran smoothly.

The Education students had three days to mark the exercises, then they sent a list with the results to the lecturers and individually via e-mail to each respondent. In the e-mails together with the marks, the testers' feedback about the answers was also provided. The two coordinators emphasise this stage of the process because they deeply support that the main role of classroom-based grammar and vocabulary assessment is to help students understand how well they have learned the target grammar and what they need to work on in order to improve following Pupura (2004: 262).

The average result obtained considering the two tests done by each Finance student accounted for 10% of their overall English course semester score.

When the testing process was finished, the Education students had to present orally the description of the methodology, test, results, as well as conclusions and recommendations. This oral presentation together with the test design accounted for 15% of their subject final mark.

5. Students' perceptions

Once concluded the whole process, both groups of students completed a feedback questionnaire about the experience to know students' perceptions, basically about their satisfaction with the project and subsequent motivation. Both questionnaires were divided into three sections. In two of them, respondents were given some statements and they had to show their degree of agreement with them (the answers were rated from 1 to 5, being 1 "strongly disagree" and 5 "strongly agree"). The third was an open comment form in which they had space to freely explain their opinions.

The items within each section were slightly different for every group since they were based on the tasks performed. For instance, teachers included in the feedback questionnaire a part where the Finance participants could give information to testers

about their perceptions of the exam difficulty, their role as teachers, an overall view of the whole experiences and suggestions to improve it. In this way they felt they were playing an active part in their own assessment process.

Concerning results, the first section dealt with students' motivation for the assignments and the whole process. Focusing now on the Education students and the tasks they had to carry out, the average rating (all the items considered) was 4.81 out of 5. That means that they found highly motivating tasks such as designing the test, playing the role of a teacher testing other students, marking the tests, and giving feedback. In relation to motivation for the process, respondents' average rate was 4.47 out of 5, which shows that actions like participating in a real assessment process, working in groups (or pairs), as well as meeting testees before designing the test, were slightly less motivating than individual tasks.

The Finance students' motivation for meeting testers before taking the test, answering a test designed by other students, receiving feedback about the results, giving feedback to the testers and participating in a real learning experience with university students obtained 4.12 out of 5 as average score.

Section 2 dealt with students' satisfaction with the project. In response to the questions about the test design, the whole experience of testing peers, the online communication with other participants, and the project coordination (English teachers + testers + testees), the most remarkable result to emerge from the data was that the average rate from the Education students was 4.5 out of 5, while the Finance students gave only 4 points.

Although the results related to motivation and satisfaction were outstanding in both groups of participants, it is interesting to point out that figures were higher in the Education students' questionnaire results in both motivation and satisfaction. Some conversations with participants highlighted that the Education students played a longer part in the experience what made them feel more involved. However, although the Finance students this year had also gained protagonism in the whole process, they did not feel as concerned as the students playing the role of testers.

The last section, based on students' comments, provided highly positive feedback. In the case of the Education students, they assured that they had learnt a lot, they really valued the possibility of developing tasks related to their future job, some emphasised that they liked the experience because they could see the difficulty of preparing and correcting an exam, basically all of them described the experience as innovative and very enriching, even one student remarked that this had been the most interesting activity they had never done before in their degree. There were not many suggestions to improve the project and the ones they made were related to the lack of time, for example, one student would like to have an extra class with the testees before the exam in which they could explain some aspects that may cause problems during the test, and another requested more time to create the exam.

The Finance students found the tests easy or adequate, but none of them thought they were difficult. In fact, only one test taker failed. As regards the part played by the testers, the Finance participants reported that the Education students answered satisfactorily all the questions they had during the exam, they highlighted that testers did a good job, and even some found the experience funny. Most stated that the project was very good and something different, they remarked that it was a good way for the

Education students to learn how to be teachers. With respect to suggestions, testees proposed having fewer testers around in the classroom and they would like testers to be more careful when marking the tests, since a couple of mistakes were made, although they were corrected by the coordinating teachers before the beginning of the test administration.

As it can be seen, the impressions described in section three were more positive than some of the ratings obtained in sections one and two, in which some students did not select the highest mark. The reason for these rather contradictory results was not entirely clear, but comments showed that some of the items presented for them to rate were, in their opinion, not clear enough.

6. Conclusions and further action

The experience was greatly rewarding for all the parties. Testers and testees were able to engage in their testing system as active actors and understand its objectives and difficulties from within the process.

Moreover, the English lecturers became aware of their students' testing perspective, and the need to create real settings where learners could apply their theoretical knowledge. They also realised that the students who acted as testees were decidedly willing to help the Education students improve the tests as well as the process. The Finance students got into their role and followed the testers' instructions as if they were their actual teachers. Besides, the Education students valued the possibility of performing as real testers. On the whole, the coordinators observed that the testers and the testees responded positively to this innovative activity that they had never done before. Furthermore, the lecturers experienced that giving responsibility over peers is a method that makes students engage in any activity because their motivation increases sharply.

Students' self-reported degree of satisfaction was essential in order to evaluate the project. These results have reinforced the coordinators' confidence in the effectiveness of a peer assessment project across educational levels. All in all, the experience had a positive washback effect on the English subject and subsequent tests, but there are still some modifications to add. Specially the whole process will have to be adapted to students and circumstances in each academic year.

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THE ADAPTATION OF VALENCIAN UNIVERSITIES TO BLENDED LEARNING REFLECTED IN TEACHER SATISFACTION SURVEYS

Guillem Escorihuela

Florida Universitària, Catarroja, Spain
gescorihuela@florida-uni.es

Lourdes Chuliá-Peris

Universitat de València, València, Spain
lourdes.chulia@uv.es

Abstract. The impact of Covid-19 on society has affected all public and private levels. Also, to the education sector, and in Higher Education. During the 2020-2021 academic year, the teaching activities were moved to the virtual format to comply with the health measures restricting the movement of people. The different modalities of attending the non-face-to-face student were different depending on the subject, specialty, type of teaching, faculties, or departments. Generally, they consisted of (1) live classes through streaming, (2) recorded classes, (3) autonomous work through digital resources and online feedback with teachers and, (5) autonomous work through readings. The student satisfaction questionnaire is the tool most used by universities to find out the opinion of students about the teaching received. Through certain adapted dimensions, it is possible to evaluate the teaching quality construct and the qualities that the teacher must develop to achieve educational excellence. The survey instrument is implemented in most universities in developed countries, and in the Spanish environment, it has been approached from different fields with a diverse treatment. The objective of this research is to know how traditional universities subject to blended learning have adapted their teacher satisfaction surveys to address differences in teaching models. In this sense, the study population is the Valencian universities that, following the Recommendations of the Spanish Ministry of Universities of June 10, 2020, for a presence adapted to the Covid-19 pandemic. The resulting sample consisted of 7 universities and affiliated centers. Through a review of the teacher satisfaction surveys of Valencian universities, the questions are categorized based on the highest frequencies in different items. The results aim to generate a survey model that could produce valid results to evaluate blended teaching.

Key words: *blended teaching; teaching quality; satisfaction surveys; college quality; adaptation to Covid-19*

1. Introduction

The Action Protocol for the beginning of the university course 2020/21 of July 24, 2020, to adapt the 2020-2021 university course to an adapted attendance and action measures of the universities in the event of a suspected or positive case of COVID-19 of June 10, 2020, led the Valencian network of universities and affiliated centres to propose a blended course with restrictions due to social distancing. This course consisted of splitting the class-groups into two subgroups, alternately, where the students received face-to-face classes one week, and another, non-face-to-face classes. This Protocol was signed by the five Valencian public universities, the

Valencian Government, and covered by the Recommendations of the Ministry of Universities.

The non-face-to-face classes could consist of online monitoring of the live class, monitoring of the recorded class, autonomous work through digital resources and online feedback with the teaching staff. In addition, in some episodes of the course they have had to cancel the face-to-face classes and transfer them to virtuality. This study addresses how student satisfaction surveys that evaluate teaching quality have been adapted to the non-face-to-face modality.

Suspending face-to-face teaching at universities meant that all of them were immediately transferred to an online format. This action, urgent and sudden, is not analogous in terms of experience, planning and development with the proposals designed to be taught virtually. This step was taken as an emergency response without the prior redesign of the subjects designed to be taught and taken in person. In addition, some teachers did not have the abilities to manage and make use of educational digital platforms and there was a lack of resources to create content and activities through them (García-Peñalvo et al., 2020).

As Llorens-Largo (2020) indicates, non-face-to-face teaching requires redesigning the learning experience and putting teacher-student interaction at the centre of online training. Therefore, and according to García-Peñalvo et al. (2020), digitizing content, replacing face-to-face classes with synchronous classes in a virtual room, or sending reading material is not the best option for online education.

Against this background, the research question arises based on how teaching quality has been measured in traditional universities. This study addresses the way in which Valencian universities have adapted student teacher satisfaction surveys to the blended reality.

Student satisfaction surveys in the Spanish University have been treated from different fields. Moreover, these surveys have been implanted in most universities in developed countries. Even so, there is a debate about the suitability and true purpose of these assessments (Llorent-Bedamar and Covango-Delgado Palma, 2019). For García-Berro et al. (2011), we are facing one of the challenges of the Spanish university system. Despite we have bibliometric indicators to evaluate the quality, the quantity and impact of research, we do not have such indicators to evaluate teaching.

In view of this, these authors consider that the dimensions subject to evaluation are teaching planning, the development of teaching activity and the results of the activity. On the other hand, at an instructional level, it seeks to increase the effectiveness of teaching to improve the teaching-learning process. Thus, the usual forms of evaluation combine aspects of formative and summative evaluation. It considers teaching activity is very complex, and the measurement of its quality includes different components such as expository clarity, organization, motivation and feedback (Bol -Arreba et al., 2013).

One of the main complaints about the validity of teacher satisfaction questionnaires that some authors show (Llorent-Bedamar and Covango-Delgado Palma, 2019 and Castro Morera et al., 2020) is the definition of the teaching quality construct. In this sense, the dimensionality of the questionnaire and the way of organizing the items, as well as the presentation of the questions, become important. In the first case, there are indices such as Student Evaluation of Educational Quality that propose certain

dimensions. In the second case, some authors such as García-Berro et al. (2011), present a model based on a Likert scale, like most Spanish universities (Matosas-López, 2019). However, Matosas-López (2019) and Matosas-López et al. (2019) bet on questionnaire models with Behaviorally Anchored Rating Scales (BARS) and even questionnaires that use open questions. On the other hand, Pérez-Sánchez et al. (2018) proposes, based on social psychology, the use of indirect items as the most appropriate formula for evaluating aspects that may be conditioned by social desirability or courtesy bias.

To sum up, based on the experience of previous research (Chuliá-Peris and Escorihuela, 2021) and the teaching quality construct defined by the theories and surveys analysed, in the context of social and health measures that have led traditional universities to blended teaching, it would be possible to propose a model of virtual teaching quality.

Thus, teacher satisfaction surveys will have to rethink the quality construct and adapt it to the new reality, considering that university teaching is one of the professions that should have been strongly affected by the expansion of information and communication technologies (Reyero, 2014).

2. Methodology

The objective of this research is to know how traditional universities subject to blended learning, have adapted their teacher satisfaction surveys to address differences in teaching models. In this sense, the study population is the Valencian universities that follows the Recommendations of the Ministry of Universities of June 10, 2020, for a presence adapted to the Covid-19 pandemic. The institutions were tracked and the surveys of almost all of them were obtained. The resulting sample consisted of 7 universities and affiliated centres.

The methodology is based on a review of the surveys of the course 2020-2021 in blended universities (N=7). The data analysis is based on the quantitative perspective using frequencies through categorized items. The qualitative approach analyses the survey questions, categorizes, and codes them. Dimensions and subdimensions which appear in the table, have been chosen because they appear in the different surveys.

The hypothesis of this research suggests an inference from the dimensions and items that present the highest frequency in each survey. With this, we will be able to announce the differences and similarities between them.

3. Analysis and discussion of results

After having analysed the questionnaires, it should be noted that practically all the questions are based on the Likert rating scale, since they are presented in the form of levels of agreement and disagreement.

When we analyse in depth the surveys of the universities with blended attendance adapted to the health emergency (Table 1), it is observed that items such as the usefulness of teaching materials, attention to students, and global satisfaction are repeated more frequently. However, the adequacy of the teaching guide and the dimension of the teaching methodology are also very important, especially the motivation of the teacher and the clear transmission of knowledge by the teacher, mastery and clarity of exposition. This could be because during face-to-face sessions

it is essential for the teacher to create a direct link with the students that encourages their participation and involvement with the subject.

Some questionnaires also highlight aspects such as coordination between teachers and exams or evaluation criteria.

There are examples of adapting these questionnaires to the blended learning situation. As Chuliá-Peris and Escorihuela (2021) point out, a greater adequacy of the Florida Universit ria questionnaire is observed compared to University of Valencia, since dimensions such as regulations, methodology, and the relationship and attention to students are evaluated through new dedicated blocks exclusively in the online format. The University of Alacant (UA) proposes a simplified survey with only 6 questions and adds an alternative wording to each of the questions so that this dimension can be evaluated in the case that the teaching has been done virtually.

Table 1 Quantitative analysis by frequency of the dimensions, subdimensions and items evaluated in the teaching evaluation questionnaires in universities with blended teaching adapted to the health emergency situation due to COVID-19. UV: Universitat de Val ncia; FU: Florida Universitaria; UJI: Universitat Jaume I; UA: Universitat d'Alacant; UCV: Universidad Cat lica de Valencia; UMH: Universidad Miguel Hern ndez; EDEM: Escuela de empresa, negocios y management.

UNIVERSITIES BLENDED TEACHING ADAPTED TO THE HEALTH EMERGENCY SITUATION DUE TO COVID-19								
SUBDIMENSIONS	FREQUENCY							TOTAL
	UV	FU	UJI	UA	UCV	UMH	EDEM	
MATERIALS AND TEACHING GUIDE	X	X	X		X	X	X	6
TEACHER MOTIVATION	X		X		X	X	X	5
TRANSMISSION OF KNOWLEDGE BY THE TEACHER, DOMAIN AND CLARITY OF EXPOSURE	X	X	X		X	X	X	6
GROUP AND INDIVIDUAL INTERACTION	X	X		X			X	4
ORGANIZATION AND CONTENT (COORDINATION AMONG TEACHERS)	X	X			X	X	X	5
APPROPRIATE CLIMATE FOR LEARNING			X	X			X	3
ATTITUDE OF THE TEACHER (RESPECTFUL TREATMENT)	X							1
ATTENTION TO STUDENTS (DOUBTS AND TUTORIALS)	X	X	X	X	X	X	X	7
THE TEACHER RESPECTS THE SCHEDULE		X		X	X			3
EFFECTIVENESS: ACQUISITION OF SKILLS AND KNOWLEDGE		X	X		X		X	4
USEFULNESS OF TEACHING MATERIALS AND RESOURCES	X	X	X	X	X	X	X	7
SUBJECT WORKLOAD		X	X					2

EXAMS OR EVALUATION CRITERIA	X	X	X		X		X	5
OVERALL SATISFACTION	X	X	X	X	X	X	X	7
OPEN QUESTIONS		X	X			X		3

It is interesting to note that the UCV has a special questionnaire for students to assess the adaptation of face-to-face teaching to a totally non-face-to-face methodology. Through a series of questions based on both Likert scale, BARS and open questions, it allows evaluating aspects such as the adequacy and functioning of the platforms used, the provision of technological means, the distribution of sessions and the compliance of teachers, among other issues.

These types of complementary surveys are very interesting to know the degree of adequacy of the new approach adopted by the situation of alternating face-to-face and non-face-to-face classes, due to this new paradigm has been an abrupt novelty for universities, administrations, teachers, and students.

After comparing the frequency of items in the surveys and in order to validate a virtual teaching quality construct, we opted for a questionnaire model such as the one proposed by Llorent-Bedmar and Covango-Delgado Palma (2019). It highlights aspects such as the planning, relationship and distribution of content throughout the course, the methodology used, attention to students, the evaluation of the teaching guide and the work material, the adaptation of the evaluation system to the subject, as well as the overall satisfaction of the subject. In addition, all these parameters should be scored separately to assess face-to-face and non-face-to-face teaching. Even more, it would be interesting to incorporate a questionnaire in the middle of the semester, like the UCV, to find out the adequacy of the technological resources used in the virtual sessions.

4. Conclusions

With the results obtained, it can be concluded that the adaptation of teacher satisfaction surveys in traditional universities subject to blended learning is possible without having to readapt the item model of virtual teaching universities. The construct of virtual teaching quality in the questionnaires for blended courses adapts questions that affect the virtual interaction of the teacher, response times and participation in forums. Traditional Valencian universities have considered the idiosyncrasy of a blended course in their surveys, but even so, the dimensions of the questionnaires have not changed enough to differentiate between two types of results linked to two different teaching models. However, teaching depends on the evolution of casuistry, and this quality construct will have to be studied and reconsidered over time.

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COLLABORATION BETWEEN COMPANIES AND TRAINING CENTRES IN THE PROCESS OF SELECTING THE SKILLS AND COMPETENCES TO BE DEVELOPED WITHIN A TRAINING PROGRAMME

Jose Manuel Pastor Benlloch
Florida Universitaria, Spain
jmpastor@florida-uni.es

Antonio V. Ruiz Muñoz
Florida Universitaria, Spain
aruiz@florida-uni.es

Abstract. The speed at which technological changes occur requires continuous adaptation of training content in those areas of knowledge where these changes have the greatest impact. These changes reach the company before they reach the training centers, resulting in a time lag between the needs of the companies and the contents taught in the educational centers. This time lag generates frustration in companies as they do not see their demands fully met in terms of the skills they value in recent graduates and also in the latter as they see that despite having been trained in certain skills and competences, they find that they do not satisfy some of those most valued by companies. In order to reduce this time lag, it is necessary to involve companies in the updating of training content with regard to those skills and competences whose learning requires rapid updating due to technological changes.

The participation of companies should be limited to those qualifications that are closest to their sector of activity. In this paper we present a model of how, based on the collaboration of companies in a sector, the competences and skills that should be included in a training module have been determined. The aim is to respond to the training deficiencies detected by companies in the recent graduates they hire.

We have carried out a survey among companies in a specific sector to find out which skills and competences, according to their opinion, should be included in the teaching-learning processes in those higher level training cycles related to the sector. On this basis, we have designed a model of what this collaboration between companies, training centers and public administrations should be like.

Key words: *Training programs, updating of content, collaboration*

1. Introduction

One of the main fields of professional development is in the field of information technology, where training is conditioned by the fact that many of the contents taught have short life cycles. Hardware and software are constantly changing as a result of technological advances. Different institutions have published reports highlighting the new professional qualifications that should be part of the teaching-learning processes in the professional families included in the National Catalogue of Professional Qualifications (CNCP). The analysis of these data shows that the updating of the contents is a decisive task for their rapid updating and adjustment to the demands of the labour market.

The contents taught in vocational training must be constantly updated, and this will require the collaboration of companies. Within the field of information technologies, according to data from the European Commission in 2018, one of the sectors with the greatest growth will be in the field of mobile devices.

The Erasmus + program to support education and training is one of the most important programs in the EU and enables studies to be carried out to promote its development. The analysis of the data obtained as a result of one of these program allows us to elaborate a training development proposal where the use of MOOC technology is presented as a key to the agile development of training proposals based on the collaboration between professional associations, training centers and educational authorities.

The aim of this work is to present a model for the development of new training content based on the experience developed within the European project AppSkill.

2. Background

In 2008, the term MOOC began to be used to refer to online courses where the potential number of students is unlimited. This course format has made it possible to move towards new personalized learning experiences as a result of the modularity and scalability of its contents, as Torres D. and Gago D. (2014) point out. The methodology for this course format must address, on the one hand, the massification of virtual classrooms and a true certification of the skills of those who intend to accredit the learning of the course content (García A., Gómez P., Monge C., 2017). These factors of diversity, massification and certification have added a new degree of difficulty with respect to assessment in this type of course.

During the learning process, the role of the teacher is associated with that of a participant acting as a knowledge builder. (Ross, J., Sinclair, C., Knox, J, Bayne, S. & Macleod, H., 2014). This model of education offers opportunities to overcome the difficulties encountered in underdeveloped countries, such as those arising from the lack of sufficient qualified teachers. In this line, Pujar, S. and Tadasad, P. (2016) highlight that this situation offers local teachers the opportunity to open up international collaboration channels to improve their own training and institutional programs that support new training experiences based on MOOCs.

The rapid spread of MOOCs, the fact that they go viral, has a multiplier effect on their dissemination (Kaushik, A.; Kumar, A. 2015). This has generated some problems in another of the aspects investigated in these courses, which is the evaluation of the quality of the content (Nyoni, J. 2013). The tools used for assessment are diverse and take into account the possibilities offered by each of the existing MOOC platforms. Among the most commonly used are activities, questionnaires, exams and assignments (Gallego, M. J., Gámiz, V. and Gutiérrez, E. (2015).

Another factor of interest in these courses is that which refers to the development of the contents when they belong to subjects that are constantly being updated as a result of technological advances. It is along these lines that we present our model, in an attempt to speed up the implementation of new training programs and to dynamically update their contents, thus shortening the deadlines for the completion of the updating process. Once the contents have been revised, updating them will be a quick process, limited to uploading the new contents to the MOOC platform.

3. Justification

According to the WEF, professional skills are a critical asset for companies. Under this premise, it is essential to ensure that the skills taught in training centers are relevant and are improved during the working life of the workers themselves. If the mismatch between the skills demanded by the labor market and those that people have increases, the cost that this situation will have for companies, workers and society will be increasingly higher.

According to data published by the European Union, information technologies are present in 93% of jobs throughout the Union. More than half of the technical and professional staff, as well as a third of the managerial staff of companies require specialized digital skills in most jobs. According to the same report, the use of information technologies has increased in recent years in more than 90% of companies and there has been an increase in investment in this area to improve the efficiency of the different business processes in all productive sectors. 38% of the companies recognize that their lack of digital competencies makes them lose competitiveness (46%) and even lose customers (43%). In addition, 15% of the companies recognize that they lack digital competencies, and in this percentage, the companies that require digital competencies at the highest level stand out.

4. Data analysis

Since 1977, when the first university studies in the field of Computer Science were introduced, the training of this discipline, including the different degrees of training cycles within the same branch of knowledge, have been subjected to a large number of changes in the training curriculum of all these degrees. In the university field, there has been a change from the Bachelor's Degree in Computer Science to Computer Engineering and to the Bachelor's Degrees and double degrees where Computer Science is included. The study of specific parts of Computer Science is also included in many other degrees, such as those related to engineering or social sciences. The same has happened with vocational training: from the first degrees that appeared in the 80s of the last century to the present day, the evolution of technology can be clearly seen by observing and comparing the training contents taught.

A case in point is represented by the technical skills related to software development and, within these, those related to the programming of mobile devices are presented as one of the most valued by new workers, accustomed to learning through digital platforms. According to data published by the European Schoolnet from a survey conducted between July and August 2014, the countries participating in the European Union already included code programming as a significant part of their training curricula .

Learning objectives in the system of professional qualifications in Spain are defined in terms of learning outcomes in all official curricula. In the National Catalog of Professional Qualifications (CNCP) the professional qualifications with their corresponding professional competences can be consulted. In the qualification systems, the learning objectives are defined in terms of learning outcomes and the contents to achieve these objectives are set by the Administration. These contents are organized in modules that appear in the catalog of modules of Vocational Training.

Taking the CNCP as a reference, two groups of competencies have been analyzed: the specific ones, specific to the activities related to the programming of mobile devices, and those that we consider to be of a more general scope, more typical of business management and which are common to most professional qualifications beyond those that can be considered purely technical.

4.1 Sampling characteristics

The data under analysis are part of the European project Appskil , within the Erasmus+ program of the European Union, where institutions from Belgium, Italy, United Kingdom and Spain participated and from which the companies and institutions that facilitated the collection of data used in the aforementioned project were accessed. The data analyzed were collected from a survey sent to companies in different countries, to analyze quantitative data, and from a structured interview, to collect qualitative data. A total of 194 valid responses were obtained.

Regarding the educational level of the respondents, 55% had a university education and 45% had a level equivalent to a baccalaureate or vocational training. Of the latter group, almost half of the participants were combining their work with the study of a higher training cycle or a university degree related to the technology sector. Another aspect of interest is the years of experience working in the technology sector. Thirty percent of the people surveyed said that they had been working in the sector for less than 5 years, 20% had been working for between 5 and 10 years and 50% had been working in the sector for more than 10 years.

4.2 Competences and skills analyzed

The group of specific competencies analyzed, in turn, has been divided into two subgroups of data for analysis: general technical knowledge and design and development skills. Knowledge includes general content in the field of information technologies. Development skills include technical competencies associated with the development of specific applications for mobile devices.

Table 1 contains the results on general technical knowledge. Each column represents the level of knowledge that companies in the sector require from those who want to join the company.

Table 1. Required level of technical knowledge

Genera technical knowledge	High	Medium	Basic
Programming	74%	20%	6%
Data modelling	61%	32%	7%
Web services	59%	30%	11%
Gráphic design	56%	34%	10%
Operating sistems	47%	35%	18%
Devices architectures	38%	30%	32%
Average of the required level	56%	30%	14%

Table 2 shows the results obtained when analysing design and development skills. Here too, the level of demand is high because these activities are directly related to the production of goods and services by the company itself.

Table 2. Required level in design and development skills

Specific design and development skill	High	Medium	Basic
Application security and maintenance	76%	20%	4%
Interface development on Android or iOS	67%	26%	7%
Native application development on Android, iOS	66%	28%	6%
Usability and application design	63%	26%	11%
Mobile application testing	62%	30%	8%
User experience treatment	62%	31%	6%
Mobile web application development	57%	32%	11%
Data model design. .	57%	35%	8%
Average level required	64%	28%	8%

This high level of demand on the part of the companies is revealing, bearing in mind that the companies that participated in the survey included training plans for their workers with the aim of updating their technical knowledge in line with the companies in the sector.

If we compare the list of skills and competences of the qualifications of the technological branch in the higher level training cycles, we can see that the skills and competences analyzed here are included in the training plans of these cycles. This shows that the contents taught in these cycles are in line with the demands of companies. This circumstance should serve as an incentive for training centers to be in permanent contact with companies in order to keep the contents taught in their classrooms up to date.

Table 3 contains the results on management skills, and the level of knowledge required by the companies in the sector from those who want to join them. If we compare these results with the results of tables 1 and 2 regarding technical knowledge and design and development skills, we can see that the level of demand is very similar. As these are small companies, also in the technology sector, despite their high level of specialization, high qualifications are required in terms of the management of very specific areas of this type of company.

Table 3. Required level in management skills

Management skills	High	Medium	Basic/not required
Contextualize the use of the app	79%	18%	3%
Knowing the business model of the app	75%	22%	3%
Manage Quality in app software development	65%	24%	11%
Manage risk during app development	56%	34%	10%
Understand the legal aspects associated with app use	52%	31%	16%
Use agile methodologies during app development	53%	30%	17%
Average level required	63%	27%	10%

5. Proposed model

Based on the above data, we present a model for the development of new training content. The model proposes a linear structure as shown in the following figure.

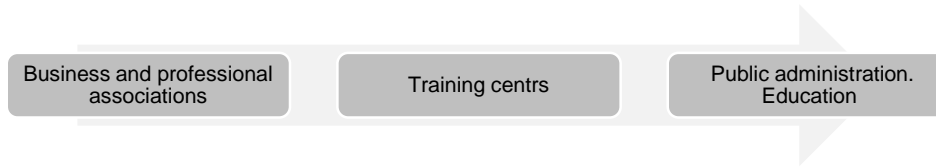


Figure 1. Linear collaboration model

The first task proposed is the responsibility of professional and business associations because they can gather first-hand information on the needs of the sector, and they are the first to detect future professional trends. The information they gather should be the seed for new training programs, both formal and informal. The model presented proposes that periodic agile analyses should be carried out and reported to the training centers when the professional associations have conclusive data. In this way, these centers will be able to plan their continuous training and the updating of the teaching staff quickly. From there, they will be able to develop learning experiences through non-formal training programs to introduce the emerging technologies they are beginning to use. The results of this training should serve as a starting point for updating formal training at the levels concerned.

6. Conclusions

The first conclusion is that if companies participate in the development of certain training content to be taught in both university and vocational training degrees, they will have less difficulty in finding new graduates who meet their needs. In the same way that companies in the technology sector demand competencies in business management and in very specific areas of knowledge of the product they develop, the same can happen in other sectors.

The second conclusion refers to training content. As in the case of companies in the technology sector, in general, in all other sectors the contents must be constantly updated in order to meet the demands of the companies. This is a fundamental factor to consider in order to prevent course content from becoming obsolete. Taking into account that MOOC platforms offer very advanced interaction options with the students, the updating of contents will be a fast process, for which the proposed model can facilitate this task.

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MOTIVATION, DISPERSION AND PERFORMANCE: HOW TO AUTOMATICALLY MONITOR ITS APPROPRIATE LEVELS

Villagrasa, J.

EDEM Centro Universitario, Valencia, Spain
jvillagrasa@edem.es

Salvador, C.

University of Valencia, Valencia, Spain
carlos.salvador@uv.es

Donaldson, C.

EDEM Centro Universitario, Valencia, Spain
cdonaldson@edem.es

Pastor, J. M.

University of Valencia, Valencia, Spain
Jose.M.Pastor@uv.es

Abstract. Consistent with previous literature, there is a clear positive link between student motivation and its academic performance. Increasing student motivation is not an easy task, however, it has drawn the attention of several scholars with the aim of identifying the different factors that influence it. Among them, it will be of vital importance to boost the activities that generate intrinsic motivation, as they provoke enthusiasm and interest for the learning process in the pupils, without the need of providing rewards or punishments. Consequently, and as research shows, academic performance will be positively influenced by this type of motivation, whereas negatively affected by the extrinsic one. Thus, our goal in this document is to propose the extension of the basic ideas of the non-traditional schooling approach of the Montessori method to the university classes, in order to move from the traditional or classical methodology usually applied (e.g., using master-lectures, repetition of concepts and memorization), and consequently stimulate the students' intrinsic motivation. The results obtained are quite inspiring, showing that the most motivated students obtain around +20% average mark in their final exam (performance), and maintain this high-motivation in subsequent courses in around 50% of the cases. However, after analyzing the students' results of the 39 subjects of the degree in Business-Administration-and-Management of EDEM-Business School, we may state that the application of this methodology should not be unique and therefore can be discussed, as with different educational techniques other subjects also achieve similar output. Therefore, with the aim of taking this research to a higher sphere, we provide an automatic monitoring tool or dashboard where regardless the methodology applied by a subject/professor, he/she and the educational institution itself could know its level of results, especially when professors have junior profiles or are new in the educational institution. To do so, we compare the students' academic results (reflecting its level of motivation) –which varies from 5 to 7,7 along the degree– with its level of dispersion –which varies from 23% to 56%–, due to as research shows, dispersion is negatively related to performance (i.e., less disperse classes would generate a general improvement in learning, therefore provoking better output) and could also work as a check lever. Our results show the great applicability of this tool but also encourages caution in its interpretation when comparing each subject/professor with its 'own group', differentiating among 'soft skills' ('law', 'economics') and 'hard skills' subjects ('business' and 'technical').

Key words: *intrinsic motivation, academic performance, dispersion, automatic monitoring tool.*

1. Introduction

It is a palpable reality that today's students, also named 'Gen Z' students, are different from students of past generations, In fact, they have different values, worries, thoughts, way of learning, and even, a different brain structure due to their compulsive and constant use of mobile phones and screens (Hutton et al., 2020), yet another proof, in this case tremendously objective (and even somewhat worrying), of these differences. But who exactly belongs to this 'Gen Z' group? According to Murad, et al. (2014) 'Gen Z' encompasses the set of people born from 1998 to 2010, which is also known as the 'generation of technology'. They started surfing the internet and the web even before they had begun to speak, and have been guided and encouraged by their parents to use social networking sites since childhood. In other words, the 'Gen Z' grew in a world completely connected with technology from the very beginning. In fact, at the university level, professors realize that most of the current university students (who are part of such 'Gen Z') do not use anymore the basic book or manual of the subject as the main way to obtain knowledge of the course as the students of the beginning of the decade of 2000 and before did. Instead, they use tablets, computers, and smartphones to obtain information, interact and socialize (Hutton et al., 2020; Pinar-Pérez et al., 2021). This situation has provoked that the different techniques and methodologies currently used by professors, usually based on a more traditional or classical methodology (e.g., master lectures, repetition of concepts and memorization) are not fully effective, generating a gap between the learning method used and the students, often materialized through a lack of motivation, and therefore hindering their learning and attention capacity (Winqvist & Carlson, 2014).

1.1. Relationship between motivation and academic performance

Consistent with previous literature, there is a clear positive link between student motivation and its academic performance (Ali et al., 2010; Huitt, 2001; Kamauru, 2000; Pinar-Pérez et al., 2021), understanding motivation as a state of mind that stimulates activities and actions (Ali et al., 1981). Increasing student motivation is not an easy task, however, it has drawn the attention of a high number of scholars (Huitt, 2001; Brophy, 1986; Stipek, 1988; Tuckman, 1990) with the aim of identifying the different factors that influence students' attitudes towards learning, trying to explain in this way what factors improve student motivation and which ones don't (and consequently, obstruct the learning process). Among these factors, according to prior research, it will be of vital importance to decipher whether they generate what is known as an intrinsic or extrinsic motivation.

1.2. Types of motivation: intrinsic and extrinsic

The latter one, extrinsic motivation, refers to students who are motivated to learn in order to achieve an objective, a reward, or avoid a punishment, both external to the educational activity itself (Dev, 1997). On the contrary, an intrinsic motivated student does not need a reward or a punishment to be engaged with the process of learning itself and finds in it interest and enjoyment. Therefore, as Ali et al. (2010) argued: *"students with intrinsic motivation are more enthusiastic, self-driven, challenging and feel pleasure in their studies, and (however) students with extrinsic motivation try to*

drag themselves with academic assignments, feel compelled to learn, and always put minimal efforts to achieve maximum performances” (Ali et al., 2010, pp. 81). As a consequence, and as research shows, academic performance will be positively influenced by intrinsic motivation, whereas negatively affected by extrinsic motivation (Ali et al, 2010). Accordantly, our final purpose (and the purpose of this paper) should be (and actually is) to stimulate the intrinsic motivation of the university students. Nevertheless, it is important to state that to try to achieve such motivation, professors and policy makers in recent years have bet (almost) everything (and, by the way, unsuccessfully) on the use (only and simply) of ICTs, without really modifying its methodologies (or barely doing it). As a consequence, the results of the students have not been improved, and they have continued to show a scourge in their motivation processes produced by the lack of fit (between the learning method used and the typology of students) mentioned above.

1.3. ‘Gamification techniques’ inspired by the Montessori methodology

To try to solve this problem, in this paper it is firstly intended to propose the utilization of a learning system based on ‘gamification techniques’ normally understood as the application of typical elements of game playing (e.g. ‘point scoring’, ‘competition with others’, ‘rules of play’, etc.) to other areas of activity, such as in this case, education. These techniques, which usually stimulate the active and autonomous learning process of the students (cf., Fernández-Moya et al., 2020), in this paper are proposed to be used together with some of the fundamental principles on which the Montessori method is based (Kramer, 1976; Lillard, 1996; Montessori, 1912). This methodology, world-renowned¹², was developed by Maria Montessori at the turn of the 20th century, and first explained to every educator of the world by its first book “*Il Metodo della Pedagogia Scientifica applicato all' educazione infantile nelle Case dei Bambini*” (published in 1909). This educational philosophy and methodology which firstly (and even nowadays) seemed somewhat provocative, ended up being used worldwide for more than a century to the present day, usually educating children from 3 to 12 years old. The proposal of such methodology is tremendously simple, specifically arguing that the educators would need to make sure to merely provide three key aspects (Cossentino, 2005; c.f. Montessori 1912, 1966, 1967, 1972, 1973, 1995):

- Firstly, very concise, simple, short, and well-prepared lectures;
- That, secondly proportions freedom to the students to choose activities, stimulating them to learn voluntarily, autonomously and at their own pace (and thus respecting its individuality, with self-correcting activities that allow its self-education and let the students to not need external supervision to check if they are doing well), acting as enablers and guides of the process but in no way forcing it;
- While thirdly, establish a very cared, well-prepared, and propitious environment to facilitate the learning process.

Thus, our first goal in this document is to propose the extension of the basic philosophy and underlying ideas of the Montessori method to the university classes, in order to improve the outcomes in terms of student motivation, but also engagement, maturity, and critical thinking (Fernández-Moya et al., 2020). Taking this into account, our initial

¹² Likewise, it is important to state from the first moment that we are not Montessorian, which means that we simply offer an external vision of the Montessori education method with the aim of completely letting the reader develop its own opinion on this matter.

hypothesis states that the non-traditional schooling approach of the Montessori method could be easily materialized and combined through the previously mentioned 'gamification techniques' thanks to the use of the ICTs, which in this case, would enjoy of a positive strengthening of its characteristics due to, in this time yes, they would come accompanied by a methodological change (Fernández-Moya et al., 2020). Specifically, these 'gamification techniques' will come represented by simple multiple-choice questions answered in a totally voluntary and playful way on the smartphones or electronic devices of the university students, using platforms such as 'Quizizz', 'Kahoot', 'Socrative', or even merely the 'Virtual Campus'. With this, we would generate the possibility of verifying in a very accurate way the knowledge acquired by the student after each session (by both the professor and the student itself), but also to boost an intrinsic motivation and implication within the students (Ali et al., 2010; Fernández-Moya et al., 2020) both in the short term (to demonstrate their learning, reflection, analysis capacity and ability to relate concepts versus the rest of its classmates) as well as in the long term (since the student could obtain optionally extra points according to its performance –first long-term motivation–, and similarly, some future potential help to better prepare its final exam by repeating the questions as many times as he/she would like to, individually and without any external supervision –second long-term motivation–). As a consequence, it would be easy to identify that this activity would not follow the traditional or classical methodology (e.g., using master lectures, repetition of concepts and memorization) but a totally different one, applying the precepts introduced by the Montessori methodology to achieve an adequate intrinsic motivation and fit with the students (1. using simple and concise contents; 2. that stimulate latter on the autonomous and individual learning; 3. in an environment that is created conscientiously to generate such proper intrinsic motivation and implication in the student and its learning process), thanks similarly to the use of the ICTs (in this case through electronic platforms such as 'Quizizz', 'Kahoot', 'Socrative', 'Virtual Campus', etc.), in this case and unlike previously, accompanied by a latent methodological change.

1.4. Other possible options to achieve the desired motivation in the students

Despite the theoretical positive implications of this methodology, in this paper we also provide detailed empirical evidence of it using one of the electronic platforms proposed ('Kahoot'), and measuring the effect that intrinsic motivation had on students' results in 9 subjects of the degree in 'Business Administration and Management' of 'EDEM-Business School'¹³ (Valencia, Spain). However, although the output obtained is very promising (with a not inconsiderable impact of intrinsic motivation of around 20% on pupils' performance), the results shown are not comparable with other subjects or institutions. Or at least in a quick and easy way. In fact, due to the current data protection law, we cannot get access to the notes made by different other professors when assessing the intrinsic motivation of their students, so we cannot relate or track them with its academic results. Or what is worse, we cannot even know in some cases

¹³ 'EDEM-Business School' is an academic Spanish institution founded in 2002. Currently, the institution is affiliated with the two major public universities of the area: the 'University of Valencia' and the 'Polytechnic University of Valencia'. Besides, the institution has an education offer of 50 programs including university and management training, holds 2,500 students and employs more than 500 professors and researchers. Likewise, 'EDEM-Business School' is part of 'Marina de Empresas', a consolidated business ecosystem formed by a business accelerator, 'Lanzadera' an investment vehicle, 'Angels', and a training center, 'EDEM-Business School', gathered in what has become as one of the most important and successful entrepreneurial hubs of the Mediterranean area.

the name of the professor that taught such subject, which leaves us without the opportunity of knowing which methodology was applied during his/her classes.

Consequently, with the aim of taking this research to a higher sphere in this paper we propose a homogeneous tool that allow us to compare the results obtained by different students in the different subjects of different degrees and institutions, applying in each case the same or a different methodology, and in this way avoiding the problem arising from the protection of student data. To do so, the paper discusses about the different ways to assess “academic success”, evaluating for this purpose distinct dispersion measures such as ‘variance’, ‘standard deviation’, ‘coefficient of variation’, ‘bloxpot’, ‘quartiles’, etc. and selecting the best one to appropriately and at a first glance obtain it. Besides, analyzing data of the 39 existent subjects in the degree in ‘Business Administration and Management’ of ‘EDEM-Business School’ during the academic course 2020-2021 the paper is able to develop a global analysis among the different years of the degree (1st, 2nd, 3rd, 4th) and among the different existent group of subjects (‘business’, ‘law’, ‘economics’, and ‘technical’) which, from our perspective, allow the students, educational institutions and professors to better understand the diverse performances obtained by all of them. To be more specific, this analysis would be able to generate a sort of monitoring tool or dashboard where for example help the students to understand the difficulty of one course versus the other, due to the type of subjects included in each course. Something that would also help them to foresee and make better predictions about their chances to apply to some scholarships, Erasmus programs, master’s degrees, awards, recognitions, etc. But also where the educational institutions or professors could identify potential deviations from the normal or acceptable performance (especially when the professors have junior profiles, start teaching a new subject, or are new in the educational institution –and do not know very well which level of demand they should apply or is expected from them–), comparing one subject with another one or with a group of subjects (for instance, the one of the ‘business’, ‘law’, ‘economics’, or ‘technical’ group). Or even, realizing that a mere comparison of an individual subject with all the subjects of one full academic year (for instance, all the subjects of the 1st, 2nd, 3rd, or 4th course) or the whole degree would not make any sense because they would have (and mix) subjects belonging to different groups and difficulties, and therefore the comparison will not be appropriate *per se*. Moreover, with the analysis proposed in this paper, it would be avoided one of the main problems present in the literature, where usually it is simply studied one subject or group of subjects individually (c.f., Castedo et al., 2017; Díaz-Silva, 2018; Mateos-Ronco et al., 2019) instead of providing a global vision.

2. How to achieve motivation? comparison of different subjects with different methodologies

2.1. The first activity proposed: a success in results but a failure when it comes to being able to compare with other activities and subjects

As previously mentioned, in this paper it was firstly tried to measure the existent relationship of the students’ intrinsic motivation, measured by the performance obtained in their multiple-choice tests along the course using the platform ‘Kahoot’, with its academic performance, measured by the performance obtained in the final

exam of the corresponding subject, therefore determining the effect of such methodology¹⁴.

To do so, we analyzed the different results obtained by the undergraduate students of the degree in *'Business Administration and Management'* of *'EDEM-Business School'*. In particular, these results were checked in a total of 9 subjects¹⁵ of this degree during the academic years 2019-2020 and 2020-2021. All of the subjects were taught by one of the authors of this paper (and thus acting as a control variable of the study) due to obvious reasons, but mainly, to the ones related to data accessibility (therefore avoiding potential data protection problems for the identification of the students). Likewise, this professor taught in all the courses/years (1st, 2nd, 3rd, 4th), which facilitated the monitorization of the evolution of the students. Likewise, it is important to state that as mentioned in the prior section, in this activity *'gamification'* techniques were applied using a non-traditional schooling approach of the Montessori methodology. In this sense, after the analysis, it was found that the *'top 3'* students over all the multiple-choice tests/*'Kahoots'* performed¹⁶ –i.e., the students with more intrinsic motivation both in the short and the long term– obtained a +23% more in their final exam grades than the rest of the class (*'6,6'* versus *'5,9'* = *'+1,7 points'* = +23%) (see Figure 1 below). Similarly, the *'top 10'* students over all the multiple-choice tests/*'Kahoots'* performed –i.e., the students with more intrinsic motivation both in the short and the long term– obtained a nothing inconsiderable +14% more in their final exam grades than the rest of the class (*'6,8'* versus *'5,9'* = *'+0,9 points'* = +14%). Moreover, it is important to note, especially for the following sections of this paper, that the average grade of the 9 subjects was *'6,2'* (versus *'5,9'*, that was the average grade of these 9 subjects for the students that were not top students, that is to say, that were under the *'top 10'* pupils of the class). Likewise, another remarkable fact is that 66% of the students that were in the *'top 3'* in prior occasions/years, repeated in the following years, while 40% of the students that were in the *'top 10'* in prior occasions/years, repeated in the next years. That is to say, as the theory argues, we can observe that the intrinsic motivation itself makes the students find interest and enjoyment in the learning process, feeding back their desire to keep on outstanding (Ali et al., 2010).

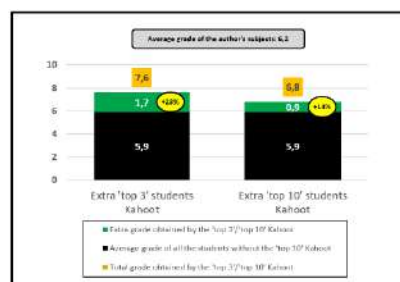


Figure 1 Differences between the grades of *'top3'/'top 10'* students in the *'Kahoot'* and the rest of the class

¹⁴ It is important to highlight that this study is embedded within the educational innovation research project titled "The students as managers of their learning process. An adaptation of the Montessori Method for Generation Z university students" (UV-SFPIE_PID-1639614), developed by the research group Ecolnnova of the University of Valencia (Spain), an educational innovation research team which has more than 10 years of experience working together.

¹⁵ Note that some of them could be the same subjects but taught in different years (2019-2020 and 2020-2021).

¹⁶ Note that usually one multiple-choice test/*'Kahoot'* was performed in each of the 9 subjects after each unit was taught, either that exact same day or the day after having covered the content.

These two outputs of information are extremely helpful as they could help many colleagues to understand the importance of achieving a high intrinsic motivation (and learn ways to do it) in their pupils (as well as showing these results to the students, to make them understand the benefits of such methodology/activities performed in class and arouse their interest in it). Nonetheless, with the aim of taking this research to a higher sphere, we should compare this methodology with some others in order to check their potential advantages and drawbacks. However, unfortunately, due to current data protection law when identifying the students we could not know for instance:

- The name of the professor of the subject: so we could not ask him/her about the methodology followed or if he/she followed any methodology to motivate its students.
- The names of the students: so we could not track them through the different courses as each time could have different ID numbers; and we could not also know if they were doing good in the 'Kahoots' or in whatever other activity/were intrinsically motivated to relate it with their academic results.

2.2. How to be able to compare different subjects with different methodologies if some information is anonymous?

So, what could we do? In terms of looking for a homogeneous comparison tool that allowed us to compare the results of the different students in the different subjects of the degree of 'Business Administration and Management' without needing any personal/sensitive information (as seen before, forbidden to obtain it), we analyzed the differences in the grades obtained by the 'top 3' and 'top 10' students of the class versus the rest of the students of the class (without taking into account their potential results in 'Kahoots' or any other activity performed in class). The results in the same 9 subjects assessed before can be observed in Figure 2.

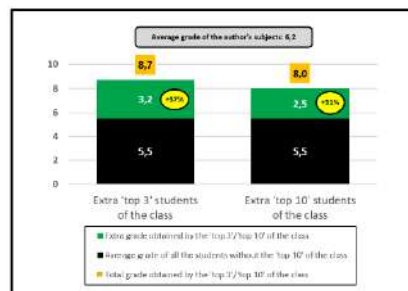


Figure 2 Differences between the grades of 'top3'/'top 10' students of the class and the rest of the class

Here we can observe that the 'top 3' students of the class obtained a +37% more in their final exam grades than the rest of the class ('8,7' versus '5,5' = '+3,2 points' = +37%). Similarly, the 'top 10' students of the class obtained a similar +31% more in their final exam grades than the rest of the class ('8,0' versus '5,5' = '+2,5 points' = +31%).

2.3. Think big: to compare these results about grade dispersion with the subjects of all the degree

The next questions would be quite obvious: “*but, how I am doing in comparison with the other professors/subjects of the degree?*” “*is this dispersion high or low in comparison to them?*”. In order to provide an answer, we obtained anonymously the information of the results in their final exam¹⁷ of the 39 subjects that are part of the degree of ‘*Business Administration and Management*’ of ‘*EDEM-Business School*’. Doing the numbers, we obtained an average of 39% and 34% respectively, that is to say, a barely +2%-3% versus the prior results (+37% and +31%). As a consequence, it seems that in these prior 9 subjects the professor was able to reduce the dispersion a bit, but in an almost negligible way. Or, in other words, the rest of professors/subjects also used methodologies (that unfortunately due to the data protection law we cannot know which ones they were) to motivate/engage/reduce the dispersion/avoid students failing behind, and actually they also worked properly. But does it happen in all the subjects in the same way? The answer is no. In the subjects where more practical and applied content is provided, as we will later define (in the next section) such as: ‘*business*’ and ‘*law*’ subjects, the dispersion was 35% and 30% in ‘*business*’ and 34% and 30% in ‘*law*’, practically the same than in the prior 9 subjects (+37% and +31%). Meanwhile, in the subjects where less practical and applied content is provided, as we will later define such as: ‘*economics*’ and ‘*technical*’ subjects, the dispersion was 45% and 40% in ‘*economics*’ and 45% and 41%¹⁸ in ‘*technical*’, showing in this case, a big gap (around +10%) between the prior 9 subjects (and the prior two types of subjects: ‘*business*’ and ‘*law*’), therefore suggesting that in this case, these types of subjects would need some tips to improve students’ motivation/engagement. These results are represented below in Table 1.

Table 1 Dispersion between the grades of ‘*top3*’/‘*top 10*’ students of the class and the rest of the class per type of subjects

	author	business	law	economics	technical	all the degree
Dispersion of the ‘ <i>top 3</i> ’ vs ‘ <i>rest of the class</i> ’	37%	35%	34%	45%	45%	39%
Dispersion of the ‘ <i>top 10</i> ’ vs ‘ <i>rest of the class</i> ’	31%	30%	30%	40%	41%	34%

2.4. To provide tips of motivation within ‘*economics*’ and ‘*technical*’ subjects: the importance of firstly understand the potential relationship between grade dispersion and average grades

However, in order to be prepared to give some tips to these subjects, it would be necessary to first deeply understand the potential relationship between the level of dispersion present in the grades of the subjects and the academic performance obtained by the students (due to probably, less disperse classes would generate a general improvement in learning, therefore provoking higher academic results, as stated by Ferrer-Torregrosa et al., 2016, among others), as well as the possible connection/similar behavior of this relationship within the different types of subjects of

¹⁷ It is important to highlight that the grade of the final examen is an individual grade obtained individually by the student, therefore, it can not be biased by the potential group work marks collected in the final grade of the subject.

¹⁸ As can be observed, the dispersion obtained by ‘*top 3*’ students of the class versus the rest of the class, and the ‘*top 10*’ students of the class versus the rest of the class, keeps always a proportion, specifically more or less +5% (for instance, see the case of the 9 subjects taught by the author of this paper: 37% and 31%, the ‘*business*’ subjects: 35% and 30%, the ‘*law*’ ones: 34% and 30%, the ‘*economics*’ ones: 45% and 40%, the ‘*technical*’ ones: 45% and 41%, and the average of the degree: 39% and 34%). For this reason and to facilitate the comprehension of the different analysis done in the following parts of the paper, from now on, we will only use one of them, in particular, the first one or the one which takes into account the ‘*top 3*’ students of the class (taking into account that the second one could also be perfectly used, without generating any variation of our arguments and logic).

the degree of *'Business Administration and Management'*: *'business'*, *'law'*, *'economics'*, and *'technical'* (with probably higher grades –and less dispersion– in the *'business'* and *'law'* subjects, where as mentioned above, more practical and applied content is provided).

3. Dispersion measure and subject categorization: which one to use?

3.1. A step back (1): which dispersion measure should we use?

Nonetheless, before providing this analysis, we will need to better explain two aspects:

- The first one is related to the specific use of our dispersion measure, through which we compare the grades obtained by the *'top 3'* or *'top 10'* students in a class versus the rest of the pupils of the class (that by the way, as explained in the footnote 7, we have actually discovered that there is not much difference between the two measurements and that therefore we will use only the first one). In fact, someone could have perfectly argued the use of the *'standard deviation'*, the *'variance'*, or any other measurement of variation.
- Likewise, in the second place we will also need to better explain why we divide the subjects of the degree into four groups, and especially into *'business'*, *'law'*, *'economics'*, and *'technical'*, as someone could have argued another different partition that could therefore modify the analysis.

We will start by the first one: the argumentation of the use of our dispersion measure. To do so, we checked the different measurements usually present and used in the literature, which are mainly composed of the *'variance'*, the *'standard deviation'*, the *'coefficient of variation'*, and on rare occasions, the *'boxplot'* and *'quartiles'* (c.f., Castedo et al., 2017; Díaz-Silva, 2018; Mateos-Ronco et al., 2019 among others), all of them measures that hinder in some way the correct identification and interpretation of dispersion in a sample:

- A. Thus, normally, the *'variance'* does not provide accurate information or understanding of the existent dispersion as it is expressed in squared values.
- B. Meanwhile, the *'standard deviation'* solves this problem as it is expressed in the same units as the data from which it is calculated, showing the existent variation from the *'mean'*. Thus, a low *'standard deviation'* or close to *'0'*, would mean a low deviation from the *'mean'* of the sample analyzed (for instance, a *'standard deviation'* of 2 apples would mean that on average, there would be 2 apples of dispersion regarding to the *'mean'* of that sample, for example, apple trees). However, this measurement will hardly help to really know if the number/dispersion obtained is high or low (for instance, it would be difficult to know if *'0,5 points'* or *'1,5 points'* could be considered as something high or low, versus the ease of interpreting a +50% of grade of the top students of the class versus the rest of pupils as a high dispersion in a sample).
- C. For its part, the *'coefficient of variation'* is calculated as a division between the *'standard deviation'* (again, calculated as the existent variation from the *'mean'*) and the *'mean'*, therefore showing a relative interpretation of the degree of variability of such *'standard deviation'* versus the *'mean'*. However, as in the case of the *'variance'*, this measurement is a little bit difficult to understand and interpret. Likewise, it has another added problem, as it does not work properly when the

'mean' is '0' or very close to '0', as the measurement will reach very large values, which would not necessarily imply a large dispersion.

- To better understand these three measurements and determine if they are really appropriate to interpret the existence (or not) of dispersion in a sample, we will calculate all of them using the results obtained in the different subjects of the degree
- in '*Business Administration and Management*' (see Table 2 below). Basically, only with the measurement of the '*standard deviation*' (as the '*variance*' and the '*coefficient of variation*' are difficult to interpret, beyond knowing if there is more or less dispersion depending on whether their values are higher or lower compared to the rest of the samples) we would be able to identify which sample is closer/less dispersed to the '*mean*' than the others and how much (with a number) (e.g., 2 apples, 3 apples, or 10 apples from the '*mean*').

However, even though the '*standard deviation*' would be the best one out of the three measurements, using it would be impossible to interpret correctly the existence of a high or low dispersion (again, see the prior example where it would be difficult to know if '*0,5 points*' or '*1,5 points*' could be considered as something high or low, versus the ease of interpreting a +50% of grade of the top students of the class versus the rest of pupils as a high dispersion in a sample).

Table 2 '*Variance*', '*Standard deviation*', and '*Coefficient of variation*' of the different subjects of the degree

	A 'Variance'	B 'Standard Deviation'	C 'Coefficient of variation'
9 subjects of the author	0,20	0,45	7,27
'business'	0,12	0,35	5,52
'law'	0,23	0,48	7,61
'economics'	0,49	0,70	12,23
'technical'	0,58	0,76	12,52
All the degree	0,50	0,71	11,63

D. Some studies (although in rare occasions) also use the '*boxplot*', represented by a rectangle (usually called '*box*') which extends from the first quartile to the third quartile of the sample, thus covering the 50% of it, and showing somehow the dispersion existent in the sample: i.e., the narrower the rectangle is, the greater the concentration of the sample, that is, the less dispersion will be, and vice versa (for instance, a narrow rectangle that goes from 50 apples to 60 apples would mean that the 50% of the sample, that is to say, the data or apples between the first and third quartile of the sample, will be quite similar, with a difference of only 10 apples). In addition to this rectangle there is also a horizontal line on the left and on the right of this '*box*' (which are called '*whiskers*') and some individual points further away (which are called '*outliers*') which indicate the variability that exist along the first and fourth quartile following some specific norms (for a detailed description of the construction and interpretation of the '*boxplot*', see Peña and Romo, 1997). As a consequence, this measurement would suffer again from the problem of not being

able to identify accurately (with a specific number) the actual dispersion of the whole sample but also, as previously mentioned in the definition of the tool, it would be difficult to know if a certain size of the 'box' or 'whiskers' could be considered as a high or low dispersion (versus the ease of interpreting a +50% of grade of the top

E. students of the class versus the rest of pupils as a high dispersion in a sample).

Finally, and as with the prior measurement, some studies also use (although in rare occasions) 'quartiles'. This measurement simply divides the sample in four similar groups or 'quartiles', providing information of the three necessary values to do it. As a consequence, we would have the same information as we had in the 'boxplot' but in this case without knowing how many individuals are represented in each of the groups (something that we could somehow know by assessing the size of the rectangle or 'box'). Therefore, this measurement would be a little bit worse and less representative than the previous one, and of course would also suffer from the problem of not being able to identify accurately (with a number) the actual dispersion of the whole sample but also, as mentioned before, it would be also difficult to know if a certain quartile could be considered as a high or low dispersion (versus the ease of interpreting a +50% of grade of the top students of the class versus the rest of pupils as a high dispersion in a sample).

Nonetheless, in general, we could argue that no article that uses these dispersion measurements delves into the meaning/way of calculating them or criticizes its difficulty to be interpreted, focusing only on providing them in a mere table and determining if there is more or less dispersion depending on whether the values are higher or lower compared to the rest of the samples (e.g., Díaz-Silva, 2018; Mateos-Ronco et al., 2019, etc.). However, a simple dispersion comparison between different samples would not be enough for our study, where we would like to know the actual dispersion of the sample (with a number), as well as being able to know if this dispersion could be considered as high or low (for instance, see prior example where a +50% of grade of the top students of the class versus the rest of pupils could be then easily understood as a high dispersion in a sample). And, as the proof of the pudding is in the eating, to clearly see its improvements we can just compare the results shown in Table 2 –using the measurements normally present in the literature– versus the ones shown in Figure 2 and Table 1 –that actually use the measurement proposed in this paper, where the dispersion of a sample is shown comparing the extra points obtained by the 'top 3'/'top 10' versus the rest of pupils of the class–. Finally, someone could have argued, for example, a modification in this comparison, using the 'top 20' of the class instead of the 'top 3'/'top 10'. However, the reason behind using '3'/'10' students or '20', would come determined by the sample size. Thus, in our case, where most of the classes have between 30-50 students, the use of '20' students to calculate the dispersion would eliminate the will of this calculation: to show the difference between the top students and the rest of the class.

3.2. A step back (2): which categorization of subjects should be selected?

Next, we will also better explain the second missing aspect of our applied methodology: why we divide the subjects of the degree into four groups, and especially into 'business', 'law', 'economics', and 'technical', as someone could have argued another different partition that could therefore modify the analysis. To do so, we firstly focused

on understanding the categorization of *'soft skills'* and *'hard skills'* present in the literature. The *'soft skills'* are all those skills that a priori seem intangible, such as the ability to work in a team, resilience, critical thinking, constant learning, digital skills or data-based decision-making (Hendarman & Cantner, 2018). For their part, the *'hard skills'* represent technical or experiential knowledge that allows a worker to dominate a specific area or process within an organizational scheme (Hendarman & Cantner, 2018). Likewise, and as a curiosity, it is important to mention that according to the literature such *'hard skills'* would contribute to only 15% of one's professional success while the remaining 85% is made by the *'soft skills'* (Wats & Wats, 2009). Coming up next, we recognized that even though *'soft skills'* and *'hard skills'* are both present within the different subjects (Hendarman & Cantner, 2018), each subject will be more related to one of them (and similarly will help students to develop them in a higher level) (Chell & Athayde, 2011). Then, simply following the classification developed by Börner et al. (2018), we divided all the subjects of the degree among *'soft skills'* and *'hard skills'*, similarly creating the same four categorizations or groups used by these authors: 1. *'business'* and 2. *'law'*, linked with the *'soft skills'*; and 3. *'economics'*, and 4. *'technical'*, related to the *'hard skills'*.

4. Grade dispersion and average grades: a theoretical and practical explanation

4.1. The importance of firstly understanding the potential relationship between grade dispersion and average grades

Once solved both aspects: the one about the dispersion measure to use (A. *'variance'*; B. *'standard deviation'*; C. *'coefficient of variation'*; D. *'bloxpot'*; E. *'quartiles'*; or the proposed comparison between the grades obtained by the *'top 3'* students in a class versus the rest of the pupils of the class) and the one about the division of the subjects into four groups (*'business'*, *'law'*, *'economics'*, and *'technical'*), we are eventually ready to move on to the next stage and check the potential relationship argued previously between the level of dispersion present in the grades of the subjects and the academic performance obtained by the students (as well as the possible connection/similar behavior of this relationship within the different types of subjects of the degree).

4.2. A theoretical explanation

Research shows a clear relationship between low dispersion and high academic results simply attributed to a general improvement in the learning process, which would facilitate pupils to overall obtain better results (c.f., Ferrer-Torregrosa et al., 2016). At the same time, literature also relates these high results (and low dispersion) with such *'soft skills'* subjects previously presented through what it calls as a *'grade inflation'* (Sabot & Wakeman-Linn, 1991), clearly distinguishing departments such as *'Art'*, *'English'*, *'Business management'*, *'Philosophy'*, *'Psychology'*, and *'Political Science'* with high-grading or *'grade inflation'* (and low dispersion), and departments such as *'Economics'*, *'Chemistry'*, *'Physics'* and *'Mathematics'*, with low-grading (and high dispersion). The reasoning is quite logical:

- *'Soft skills'* subjects (i.e., *'business'* and *'law'* subjects) are normally easier to understand and learn than *'hard skills'* subjects, presenting a lower degree of difficulty (Hendarman & Cantner, 2018).

- They have more practical and applied content to the real world, therefore are easier to memorize and do not forget (Wats & Wats, 2009).
- And they are more vocational for the students of '*Business Administration and Management*', meaning that these students would choose this degree due to their preferences towards '*business*' and '*law*' subjects rather than '*economics*' and '*technical*' ones. Thus, as Chell & Athayde (2011) argue, vocationally-oriented subjects allow students to develop and improve more such subjects. Hence, as '*business*' and '*law*' (both '*soft skills*' in this case are vocational subjects for the assessed students, they would be boosted (however, it is important to highlight, that obviously, this third point would act negatively for the '*soft skills*' if the degree was in '*Engineering*', where vocationally-oriented subjects would be the '*hard skills*' ones).

4.2.1. A practical explanation: confirming the theory with group of subjects

However, despite the obvious theoretical reasoning, in this paper we also aim to test its real connotations by analyzing the existent results about academic grades and grade dispersion in the four groups of subjects ('*business*', '*law*', '*economics*', and '*technical*'). In this case, it was found exactly what was expected (see Table 3 below). Thus, '*business*' and '*law*' subjects ('*soft skills*' – '*blue*' and '*green*' colour) had high grades ('6,4' and '6,4') and low dispersion (35% and 34%) versus '*economics*' and '*technical*' subjects ('*hard skills*' – '*yellow*' and '*red*' colour) which had low grades ('5,7' and '6,1') and high dispersion (45% and 45%) compared to the first ones. These results actually follow prior research outcomes, as for instance, the one of Castedo et al. (2017) with '*engineering*' subjects, or Mateos-Ronco et al. (2019) with '*accounting*' subjects, as well as Díaz-Silva (2018) with high school subjects related to '*communication*'.

Table 3 Relationship between academic grades and grade dispersion in the four groups of subjects

	Average grades (per type of subject)	Average dispersion of grades (per type of subject)
Business ('soft skills')	6,4	35%
Law ('soft skills')	6,4	34%
Economics ('hard skills')	5,7	45%
Technical ('hard skills')	6,1	45%
Total	6,1	39%

4.2.2. A practical explanation: confirming the theory with individual subjects

Likewise, apart from checking these results at a group of subjects-level, we also wanted to double-check them individually or in a subject-level (see Table 4 below¹⁹), that is to say, without taking into account if they belonged to the '*business*', '*law*', '*economics*', or '*technical*' group. To do so, we simply selected subjects with high academic grades, in this case all the subjects with a grade higher than 7 (>7)²⁰. If we

¹⁹ Note that in Table 4, we have also added a column with the year/course where each subject is taught, something irrelevant at this moment, but that will become important in the following analyses of the paper.

²⁰ Note that the average grade of the degree is '6,1' and the maximum grade of the degree is '7,7': therefore, we took half (50%) of this difference $-7,7 / '6,1 \approx +30\% \rightarrow 30\% * 50\% = +15\% \rightarrow '6,1' + 15\% \approx '7-$, giving '7' as a result.

quickly assess the only 6 subjects with more than 7 (>7), we would notice that all of them got less than 30% of grade dispersion (<30%)²¹. Therefore, as in the group of subjects-level analysis developed before, here, in a subject-level we also obtain what was expected: the subjects with higher grades are also the ones with lower dispersion.

Table 4 Relationship between academic grades and grade dispersion in individual subjects

		Average grades (per subject)	Average dispersion of grades (per subject)	Year
Econometrics	('hard skills')	7,2	29%	3rd
Business Tax	('soft skills')	7,7	23%	3rd
International Business Management	('soft skills')	7,1	26%	3rd
Creativity and innovation	('soft skills')	7,1	23%	4th
Digital Marketing	('soft skills')	7,3	26%	4th
Final Degree Project	('soft skills')	7,7	28%	4th
Total		>7	<30%	

5. Implications of the analysis

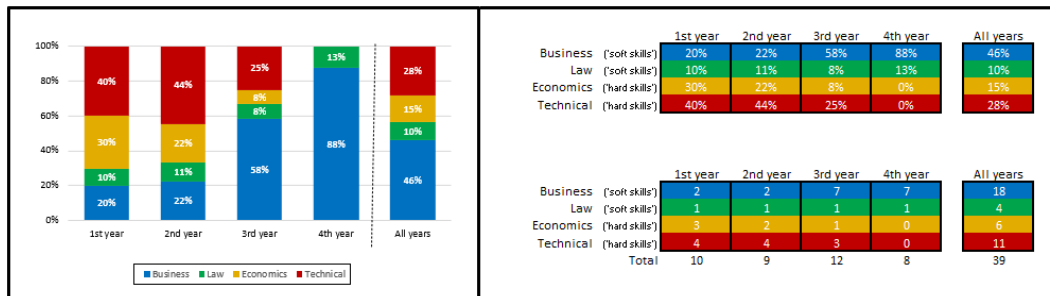
Once proved that the relationship between academic grades and grade dispersion works perfectly (and makes sense) in a theoretical and practical level (both within a group of subjects-level and in a subject-level), we are ready to move on to the next stage and deep into the analysis, to provide different applications for the educational institutions and students.

5.1. Comparison among the different academic years: to know your evolution

Thus, for example, the first implication will be related with the results of these two variables (academic grades and grade dispersion) along the four years of duration of the degree in *'Business Administration and Management'*. Will they improve each year? Could the student know them to foresee its evolution? Someone could argue that effectively the *'Darwin effect'* would act here and each year the students would obtain better outcomes. And this is absolutely true, being explained due to the bad students do not usually finish the degree (in fact, in this degree, around 20% of the total students leave it before finishing it), therefore generating "fictitious" higher grades in the students (and lower dispersion) during the last courses. However, this affirmation would not be totally correct, as with the information learnt before, we should be able to know that even the *'Darwin effect'* is there, the composition of the different courses (*'soft skills'* subjects versus *'hard skills'* subjects) would be also extremely important when giving a final verdict. Thus, as in the first and second course there is only a 30% of *'soft skills'* versus 70% and 100% in the third and fourth course, it is simple to imagine that the results will be higher (and the dispersion lower) in the last courses (see Table 5 and Table 6).

Table 5 Distribution per group of subjects during the four years of the degree

²¹ Note that the average grade dispersion of the degree is 39% and the minimum grade dispersion of the degree is 23%; therefore if we took half (50%) of this difference – 23% / 39% ≈ -50% → -50% * 50% = -25% → 39% - 25% ≈ 30%–, it would give 30% as a result, and actually there are also only 6 subjects with <30% of grade dispersion in all the degree, the prior six subjects, the exact same ones.



- Having this information into account the educational institutions and students could make better decisions. For instance, if they knew beforehand that in the first course –the only one that is actually considered when ranking the students to decide their Erasmus destination in this institution– there is a high dispersion –44%– (and thus low grades –‘5,7’–) due to the existence of a high percentage of ‘hard skills’ –70%–, they could study more/be more aware of the situation or give more support/advice to the students (in the case of the educational institutions) (see Table 6).
- And the exact same situation would happen in the second course –the only one jointly with the first one that are actually considered when ranking the students to decide their potential candidacy to take an international double degree at other prestigious universities with obviously limited spots– where there is also a high dispersion –42%– (and thus low grades –‘5,9’–) due to the existence of a high percentage of ‘hard skills’ –66%– (see Table 6).
- Finally, this information could also be useful for both actors when thinking (or encouraging the students in the case of the educational institutions) about applying to different scholarships, master’s programs, awards/recognitions, etc. once finished the degree or at the middle of it. Thus, we argue that the student would be in a better position to schedule and plan for its future possibilities if he/she knew for instance that its average grade would be increased by almost 1 point from the first course to the last course of the degree –‘5,7’ and ‘5,9’ in the first and second course versus ‘6,6’ and ‘6,6’ in the third and fourth course– (see Table 6).

5.2. The creation of an automatic monitoring tool or dashboard

The second implication will be highly useful when categorizing a subject (or a professor with the set of subjects he/she teaches) with respect to some other subjects of the degree or the set of all the subjects of it. We previously mentioned the existing differences between ‘soft skills’ subjects and ‘hard skills’ subjects (Börner et al., 2018; Chell & Athayde, 2011). Therefore, an educational institution or the professor of the subject itself, taking this information into account, could be able to know how such subject (or set of subjects that he/she teaches) is doing concerning their group of subjects (for instance, if it belongs to the ‘business’ group, the educational institution or the professor, should know that its average grade is ‘6,4’ and is dispersion 35% – see Table 3) or the set of all the subjects of the degree (knowing in this case that the average grade is ‘6,1’ and the dispersion 39% – see Table 3). In this way, this comparison system could perfectly work as an automatic monitoring tool or dashboard where the educational institution identified potential deviations or the professor knew what should be the ‘normal/acceptable’ performance (especially when the professors

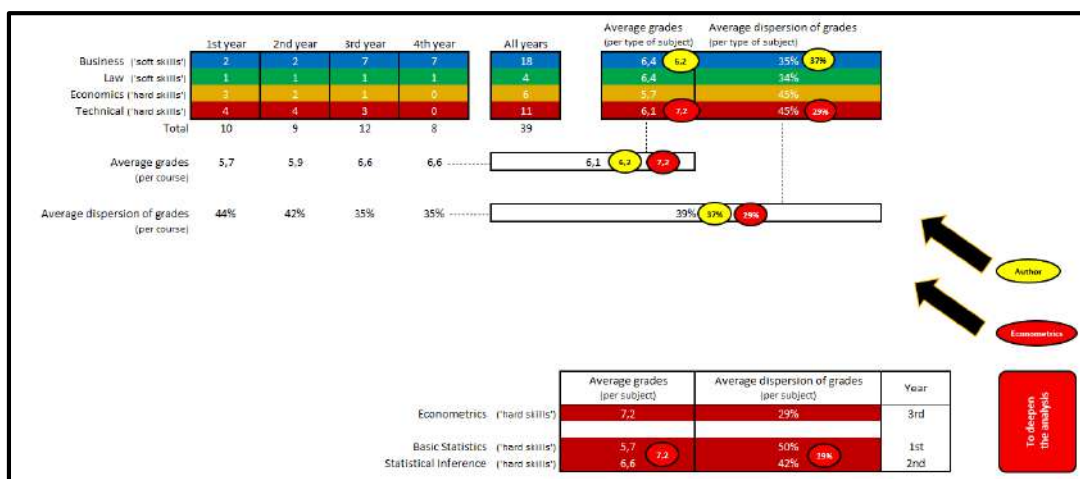
have junior profiles, start teaching a new subject, or are new in the educational institution –and do not know very well which level of demand they should apply or is expected from them–). Next, we will provide one practical example of each circumstance. However, before doing it, and although it seems obvious, it is important to note that a comparison of a subject through the different years/courses would not make any sense due to, as observed in Table 5, each one would have a different composition of ‘soft skills’ and ‘hard skills’ subjects (having therefore each one its own grades and dispersion previously discussed).

5.2.1. Comparing a subject (or a professor) with its group of subjects or the whole degree

To better understand the powerful impact of this tool, we will provide a practical example that a newly arrived professor at the institution could apply to its subjects taught to be sure that its job is well done. In this case, we will choose one of the authors of this paper and particularly its 9 subjects taught (that were previously assessed in this paper). Thus, if we check Figure 1 and Figure 2 we will be able to remember that its average grade was ‘6,2’ whereas if we check Table 1 we will be able to remember that its dispersion was 37%. But, how was this professor doing regarding the group of subjects of ‘business’ (due to the 9 subjects belonged to this group)? And what about regarding the set of all the subjects of the degree?

If we check Table 6 (and particularly the ‘light yellow’ circles, referring to the professor’s results) we could decipher that the set of all the subjects of the degree obtain on average ‘6,1 points’ and 39% of dispersion, something similar to the professor’s results. However, the group of ‘business’ subjects obtains on average ‘6,4 points’ and 35% of dispersion; thereby establishing that the professor would be totally aligned with the average of the degree, but that he/she would be a little bit more strict (or less generous) than their colleagues of the ‘business’ subjects.

Table 6 Relationship between academic grades and grade dispersion with one professor or one specific subject



5.2.2. Identifying outliers: are there subjects (or professors) with extreme values?

On the other side, another practical example of this monitoring tool or dashboard would be the search of outliers (or 'warning points') among the different subjects/professors of the degree (driven, of course, by the educational institution). Here we would be looking for individual subjects (or professors) that obtain extreme results and that, in principle, should be under inspection or observation in order to know the potential causes.

With the purpose of similarly providing a pragmatical example as we did before, we will use in this case Table 4 as a reference point of our analysis (a table that was used previously to prove in a subject-level the high grades-low dispersion relationship) where the 6 subjects with higher grade (>7) and lower dispersion at the same time ($<30\%$) of the degree are gathered together:

Nothing is apparently worrying, especially for the 3 subjects of the 4th course, all of them 'soft skills' subjects and particularly 'business' subjects ('blue' colour). Why? Due to these types of subjects have high grades (and low dispersion) and also due to the filter developed by the 'Darwin effect'.

And the exact same reasoning could be applied to the 2 subjects of the 3rd course that belong to 'soft skills', one being particularly a 'business' subject ('blue' colour) and the other a 'law' subject ('green' colour).

However, the problem would appear when analyzing the remaining subject: 'Econometrics', the only one among the 6 subjects which belongs to the 'hard skills' subjects, and particularly to the 'technical' ones. These types of subjects have on average '6,1 points' and 45% of dispersion (see Table 3 or Table 6), something really far away from the results obtained by 'Econometrics': '7,2' and 29% (see Table 4 or the 'light red' circles in Table 6 for a better comparison among both), and also taking into consideration that this subject was selected as one of the 6 subjects with higher grades and lower dispersion of the whole degree.

In this case, we could deepen the analysis (to do so, please see also Table 6, and particularly the 'light red' circles drawn along the table) and inspect a bit what was going on with this subject: 'Econometrics', a 'hard skill' and 'technical' subject taught in the 3rd course of the degree. To do so, we checked the results obtained by the two former and more related subjects taught in the degree before this one: 'Basic statistics' (1st course) and 'Statistical inference' (2nd course), both of them 'hard skills' and 'technical' subjects (as 'Econometrics'). Nothing surprising, due to as the subjects of this group of subjects (which obtain on average '6,1 points' and 45% of dispersion), these ones obtained respectively on average similar low grades: '5,7 points' and '6,6 points', and high dispersion: 50% and 42%.

6. Conclusion

As a conclusion, once reached this point, we finally would be able to work in one of the main premises that we stated in this paper: the proposition of potential tips and methodologies to improve students' motivation/engagement and, in this way, help the educational institutions to therefore reduce the dispersion of the classes (and thus improve also their grades) and avoid many students failing behind. Thus, first we could focus on improving the results obtained in these two subjects: '*Basic statistics*' (1st course) and '*Statistical inference*' (2nd course). To do so, in the first place we could

ask the professor of 'Econometrics' to provide these two similar and former subjects, with the same students (although in prior academic years), some of its tips, methodologies, magic recipes, or way of doing. One idea could be to apply the previously proposed 'gamification techniques' which would stimulate the active and autonomous learning process of the students. But also, the creation of a Montessori-type of virtual campus, where stimulating the curiosity and motivation of the student by simulating an environment with which the students will find themselves in the world of work after completing their university studies (where they could have material available to research and dig about their interests and problems), similarly very related with the freedom and individualism proposed by the Montessori methodology (Fernández-Moya et al., 2020). On the other side, the literature also proposes the use of similar tools as the ones used by the students, somehow adapting the teaching methodology to the different values, worries, thoughts, way of learning, and even, brain structure of the 'Gen Z' students (Hutton et al., 2020). Thus, some professors could discuss about the creation of short video files on the 'TikTok' social network as an educational material that would allow them to learn key concepts (such as what is 'perfect competition', 'inflation', 'public debt', 'Euribor', 'monopoly', 'mean', 'median', 'correlation', 'multicollinearity', etc.) in a quick way (due to the videos on this platform are shorter than usual tutorial on 'YouTube', lasting approximately 20 to 45 seconds). In this way, the professors would be using the social network that many of the students use for their social relationships, and also providing them with quick and fast knowledge, therefore adapting themselves towards the way these 'Gen Z' students normally operate in their lives.

Likewise, it could be the case that these subjects did motivate the students, but not in the right way, for example, working on the extrinsic motivation of the pupils instead of on the intrinsic one. As a consequence, and as research shows, academic performance would be negatively affected by such type of motivation (Ali et al, 2010). Thus, the goal for these subjects (if this was happening) would be to transfer the often short-term thinking and 'not very motivating' of the traditional, master and repetitive lectures (related with the extrinsic motivation, where an outcome or reward is presented in terms of the student final grade – Dev, 1997), to the long term, motivation and enthusiasm for the teaching received (related with the intrinsic motivation, where the student can have finally a good fit with the teaching method proposed, challenging itself, stimulating its autonomous and individual learning, and therefore enabling its self-education following its own pace and interests – Dev, 1997), thus following a learning system that stimulates the active learning process of the students, by potentially using some of the principles on which the Montessori method is based, and in this way, taking into account how the 'Gen Z' university students are, behave, interact and socialize (Fernández-Moya et al., 2020; Hutton et al., 2020).

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THE IMPACT OF COVID-19 PANDEMIC ON EDUCATION

Katarina Blažević Miše

University of Split, Department of professional studies, Split, Republic of Croatia
katarina@oss.unist.hr

Chiara – Johanna Klusmeier

University of Split, School of Medicine English Program, Split, Republic of Croatia
student_office@mefst.hr

Franjo Zubak

University of Split, Department of professional studies, Split, Republic of Croatia
fzubak@oss.unist.hr

Abstract. The corona virus pandemic rapidly changed the world with our everyday life gaining new rules to follow. The world needed to adapt to working from home as well the concept of homeschooling by means of social networks and technology. The state should have sent clear guidelines regarding the manner of teaching and at the same time ensure the smooth running of classes. The acquisition of knowledge was not allowed to stop for students at any moment with them maintaining most of their student rights but in new and changed circumstances. Although online learning has always been present in higher education with the aim of improving the present higher education with the aim of improving the quality of the teaching process, it was never used to this extent. A strong challenge was placed on employees of the education system in order to successfully carry out the transition of teaching into the virtual world. It was necessary to bring awareness to students about the importance of computer applications and social networks in learning in this “new normal”, a phrase we now use to describe life after the discovery of COVID-19 pandemic in the world. It is well known that online learning increases inequality among its participants with main consequences being reduced efficiency in education, quality of transferred knowledge and validation of the knowledge gained through online classes. The primary goal of this paper is the research of the quality of online learning during the pandemic of corona virus and on the observation of its positive and negative aspects. Also, one of the questions in the research was whether we managed to maintain at least a part of the social contact which is important for the mental well-being of young people.

Key words: *pandemic, social networks, education, online learning*

1. Introduction

It was March of 2020. that the world as we knew it stopped. The pandemic struck the world again after more than 100 years and seemingly everything was put on pause. We needed to continue with our daily lives as much as we could from the comforts or in many cases discomforts of our homes. In this paper we will be primarily speaking about the impact the COVID-19 pandemic had on education and we will provide empirical evidence to support our thesis. There was a sudden need to adjust the education that was once in person to a new form of remote studying with the help of social platforms such as Zoom, Microsoft Teams, Skype and other platforms that emerged when the pandemic started.

The education system is a global system and the international response to the Covid-19 pandemic was a shared one. This crisis, which has led to teachers rapidly developing new ways of working, as crises often do, could be a transformative moment in global education. (Cooker, Cotton and Toft, 2022.)

In this paper we conducted a survey for students of the University of Split in the Republic of Croatia where they were asked to assess the efficiency of their studying during the Covid-19 pandemic and also provide us with the information on their social and emotional well-being during the time they took online classes. The mental health of students became an important topic during this time, maybe more than it was ever considered on such a global scale because loneliness and isolation struck a large number of students.

We live in changed times. Our usual ways of living our professional and personal lives have changed and the way everyone carries out their work had to respond very quickly to government restrictions and advice. No matter where we live in the world, as the pandemic hit each country, working from home for many people became a new normal. (Cooker, Cotton and Toft, 2022.)

The problem with the new normal was that for a large number of students it was not normal at all, as there was a distinctive gap between the rich and much poorer countries in terms of the access to the Internet connection, electronic devices or in some countries even notebooks, which not all schools provided so it was up to students and their parents to provide as many devices needed for their children to take various online classes in the same household at the same time. All of that presented a challenge, even for our students in the University of Split. Even though the majority of students have an allowance around 500-600 euros a month and saved on rent and travel expenses due to online classes the majority of them did not want to keep online classes once the pandemic ends. (57,8% of participant of the survey). In the sections bellow will present the results of the survey we conducted on various students in order to describe the impact the pandemic of Covid-19 had on students and their education in University of Split.

2. Literature review

When the Covid-19 pandemic emerged, it led to a quick rush to remote learning which Harvard Business Review describes as exposing the fragmented adoption of high-quality education technology and digital capabilities across thousands of colleges and universities. With the rise of remote learning also came the rise of literature on education in pandemic to help both students as well as professors in their time in need to adjust to the new normal. The world changed in a day, and as analog on-campus learning was our normal until the pandemic, after the events in 2020. it was widely replaced with digital online learning.

Ole Skovsmose from Aalborg University in Denmark says about the book 'Transforming teaching: Lessons Learned from Teaching Under Lockdown' from Cooker, Cotton and Thoft is both an important contribution to recent educational discussion and a book which reaches deep into the future. The book draws on voices from around the world, to take a critical position with respect to the formation of future educational possibilities. Cooker, Cotton and Thoft write that the immediate response in most countries was to try to halt the spread of Covid-19 with closing schools. The

second response was to explore and develop ways that learning could move from face-to-face teaching and learning to learning being supported by virtual platforms or other forms of remote learning. Seb Jefferies, a professor working in Mongolia for the last two years says that they went online very successfully. For the first few weeks they uploaded worksheets, but after some time things became far more interactive as students and teachers became more comfortable with different online learning platforms. It was the case for many in the University of Split as well. After a short period of adjustment, both for students and professors, things were slowly put into place and the classes continued. As we can see from our paper there is a place for improvement but the main goal was for learning not to stop and we as a society managed to achieve that with all the difficulties the pandemic brought. Cooker says if we take a look at the environmental prospect – the reduction of travel and even photocopying it made significant improvements for the environment and our expenses.

Kevin Patton, an award-winning college professor who has thought biological sciences wrote in 2021. a book 'Pandemic teaching – a survival guide for college faculty' which can be most helpful in finding ways to deal with the challenges of this new normal. In the book he shares a lot of tips for quickly converting all or part of the course to a remote format. The book is described as giving an informal, conversational style while it gives useful advice to guide teachers through the pandemic teaching.

As this is a rather new subject to write about, considering only two years since the pandemic started, there will likely be many more stories to tell and books to write regarding the experiences in the pandemic, and we will surely have much more to learn from it.

3. Research methodology

3.1 Materials and methods

The aim of this paper was to discover the ways how did the students coped with online classes during the pandemic. We also wanted to see their experiences (the positive and the negative ones) and to establish how much digital technology influenced on their ways of learning and participating in classes. A cross-sectional study was carried out among students. All students from the University of Split were eligible as participants in this study. The survey was administered to students of all academic years, in an online version created in “Google Docs” during a period of 28 days, from 6th March until 2nd April. The participation was voluntary, anonymous and without compensation.

The background of the research was explained in the title of the study. A total of 85 students participated in this study, but we had to exclude two participants, because they were students of the University of Dubrovnik and University of Cologne, leaving us with a final number of 83 participants. In the survey, the students gave their general data: socio-demographic characteristics such as: age, gender, faculty and the year of study, as well as the mode of study, ERASMUS program participation status and their living arrangements. The students further had to provide information for the time period of online classes during the pandemic, what kind of and whose electronic device they used for attending online classes, which programs were used, how able they were to manage online classes, the level of education of their professors for using this model of classes and also how much they enjoyed their online classes. Furthermore, students

were asked to assess the efficiency of their studying during the covid-19 pandemic, as well as if the knowledge assessments during the pandemic were ethical or not and their study habits, and the reasons for better or worse studying compared to before the covid-19 pandemic.

Students were asked did they save money from rent and travel expenses, they needed to provide information on their social life and emotional well-being during the time of online classes of the covid-19 pandemic, including how lonely or isolated they felt without in-person-classes, how they kept social contacts, along with the information if they missed in person classes during the pandemic and if they would like to keep the online classes after the pandemic. The survey consisted of two open questions, asking the students to write down the most common problems they met and the non-compulsory question to give one advice to their professors regarding online classes.

The link for the survey was distributed by us authors, through e-mail, "WhatsApp" and social media. The results were analyzed using the built-in features of "Google Docs". The survey is added as the supplementary material at the end of the article.

3.2 Empirical results

In this study of the 83 included participants 68,7% of students (57 out of 83) were female, 28,9% of students (24 out of 83) were male and 2,4% of students (2 out of 83) did not wish to disclose the information about their gender. The mean and median year of birth of the participants is 1997., with the years of birth ranging from 1990. until 2002. and with 1 exceptional participant born before 1990.

Out of the included participants, 71,1% (59 out of 83) were students at the "University of Split School of Medicine" and 19,3% (16 out of 83) were students at the "University of Split - University Department of Professional studies". We had 3 participants of the "University of Split, Faculty of Law," 2 participants from the "University of Split" that did not further specify which faculty they were attending, 1 participant from the "University of Split, Faculty of Economics, Business and Tourism", 1 participant from "University of Split, Faculty of Health" and 1 participant from the "University of Split Faculty of Maritime Studies". We had no participants that were at the time of this survey participating in the ERASMUS program. We have no participants that are in their first year of studies at this academic year 2021. / 2022. The majority of students 69,9% (58 out of 83) are in their 3rd, 4th and 6th year of studies and consists of full-time students, 94% of them.

As the most of digital technology was not used a lot before the pandemic, only as an annex to regular classes with the purpose of its improvement, this way of teaching was extremely challenging.

Second step of this research is in analyzing private organizational capabilities of students in online class attendings with its advantages and disadvantages. According to our survey results only 3 participants did not have their own computer, laptop or tablet for the time period of online classes and used their parents' device, their work device or mobile phone instead.

Of the participants nobody lives in the student dormitory, 33,7% of students (28 out of 83) live alone, close to one quarter of students live with their parents 27,7% (23 out of 83) and the majority 38,5% of students (32 out of 83) lives with friends, roommates,

siblings or with a partner. 34,9% of students (29 out of 83) saved money on rent and travel expenses due to online classes.

The monthly allowance/income among the participants ranges from <100 € per month up until >1000 € per month, with the median allowance being 500-600 € per month.

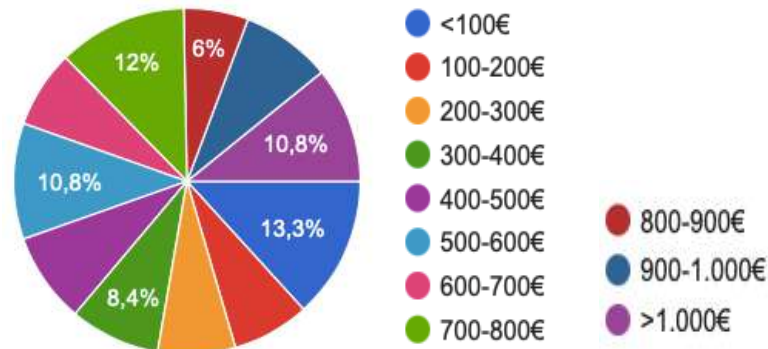


Diagram 1: Monthly allowance/income of students.

The most widely used program for online classes amongst our participants was “Microsoft Teams”, less widely used were “Moodle” and “Zoom” and the least widely used was “Skype”.

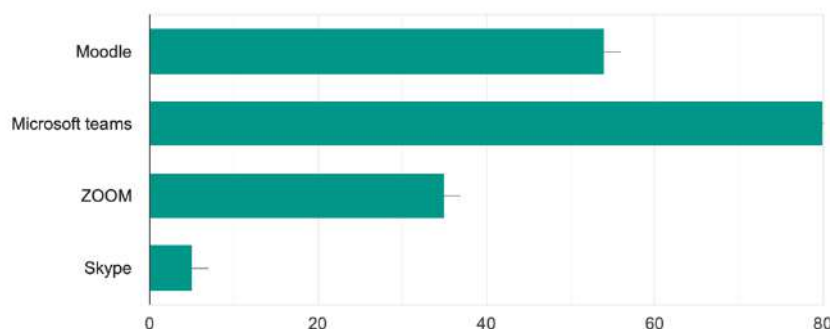


Diagram 2: Programs used for online classes.

Over 50% of students (47 out of 83) stated that they were able to manage “good to very good” with this model of studying, but only 42,2% of students (35 out of 83) enjoyed online classes during the pandemic. 24,1% of students (20 out of 83) were able to manage “not good to not bad” with this model of studying and 19,3% of students (16 out of 83) gave their management with this model of studying a negative rating. 32,6% of students (27 out of 83) did not enjoy online classes during the pandemic. 25,3% of students (21 out of 83) voted neutral on the question whether they enjoyed online classes. 68,7% of students said they missed in person classes during the pandemic. 47% of students stated that their study efficiency during online classes was below the quality of study efficiency of in person classes and 27,7% of students (23 out of 83) stated that they studied worse than before the pandemic. 34,9% of students (29 out of 83) stated that they studied better during the covid19-pandemic and online classes. 59% of students (49 out of 83) gave as a reason “more flexible time

management”, as well as easier accessibility of classes (24,1% of students) and easier accessibility of study materials (21,7% of students), comfortable surroundings (26,5% of students) and the possibility to record classes (31,3% of students).

The reasons for worse studying were predominantly a lack of self-discipline in 39,8% of students, but also reduced interaction with the professors in 34,9% of students. Out of 83 participants in the survey 19 students had technical issues, 7 students did not have access to the necessary programs and 20 students stated their worse studying was due to a worse work-life-balance. 12 students had health-issues and 7 students had family issues both due to covid-19.

18.1% of students would not want to have any online classes anymore after the end of the pandemic, with the majority being interested in at least some online classes after the pandemic. That leads us to a conclusion that majority of students still wants attending classes in person.

Only 30,1% of students found their professors to be badly educated for this model of classes, the majority of 41% professors was found to be neither good nor badly educated of this model of classes by the students and 28,9% of students found their professors to be well educated for online classes.

When asked to give one advice to their professors, only 33 students out of 83 answered this optional question, with most telling their professors to get to know the program before the lessons, that is to prepare better ahead of the class and other advice being contradictory, some students advised the professors to interact more and some to interact less.

4. Conclusion

How might our teaching be transformed as a result of the changes that the pandemic has forced on us and what have we realized are the practices that should stay with us are the questions most authors and students ask themselves. We could and always should have a wholly online introduction for those who cannot afford or take the time (Cooker, 2022).

Even though in our survey students expressed they wanted to go back to taking classes in person due to various reasons (in their answers we discovered a lot about the state of their mental health, increasing depression and loneliness due to isolation and the challenges many professors and students faced regarding the quality of online classes and the challenges of taking exams online with the risk of a failing Internet connection during exams which many experienced) we also believe that the students should have the option of choosing to take the classes remotely if it is more convenient for them because the pandemic thought us that it is in fact possible and it has its own benefits. One of the benefits for students was saving money on rent and travel but considering all their responses the great majority find that insignificant considering the negative aspects it had on their experience in general.

The students from our survey (47% of the participants) stated that their study efficiency was below the quality of study efficiency of in person classes. As the reasons for such results most of them stated poor quality Internet connection, especially during exams, no access to study materials and recorded lectures which will help them to relisten and analyze the lecture after the class considering the isolation and all the time they had to spend at their homes alone, the need for more practice in hospitals (for medical

students), lack of computer knowledge on professors side where they could not always keep up with fast paced modern day technologies and therefore could not present their knowledge in the best way possible for students to understand. There was a significant lack in communication and it presented a problem for a large number of students. In their open questions students also gave answers on their mental health and how the pandemic greatly impacted their well-being during isolation and online classes. There was an increased lack of motivation and self-discipline during the time of lockdown which led many to depression and anxiety, therefore decreasing their abilities to learn in isolation.

Our conclusion is that although the new normal brought in new ways to learn and connect on a global scale and in that new and difficult time we were able to continue to learn and grow as much as we can considering all the effects the pandemic had on our physical and mental health, incomes and households, there is now a great urge to returning to the normal we once knew, where the students were able to go to the library (also one of their responses in our survey), have discussions and practices with colleagues, find motivation in their everyday life and have a full experience at the school they enrolled.

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Annexe (the survey)

THE IMPACT OF THE COVID-19 PANDEMIC ON EDUCATION

The authors thank all students participating in this survey necessary for collecting information for a scientific article. We kindly ask You to answer all questions truthfully. This questionnaire is completely anonymous.

- What is your year of birth?
 - born before 1990; 1990; 1991; 1992; 1993; 1994; 1995; 1996; 1997; 1998; 1999; 2000; 2001; 2002; 2003; 2004; 2005; 2006; born after 2006
- What is your gender?
 - male
 - female
 - I do not wish to disclose

- Which faculty are you attending: _____
- What year of study are you in (1-6)? _____
- Are you on ERASMUS in Croatia?
- No / Yes
- Mode of studying?
- full-time student
- part-time student
- Who do you live with?
- parents
- alone
- friends/roommates
- student dormitory
- other: _____
- What is your monthly allowance/income?
- <100€; 100-200€; 200-300€; 300-400€; 400-500€; 500-600€; 600-700€; 700-800€;
800-900€; 900-1000€; > 1000€
- Did you save money on rent or travel expenses because of online classes?
- Yes
- No
- Whose tablet/laptop/computer do you use for attending online classes?
- I own my own laptop/tablet/computer.
- I use my parents' device
- I use my friends' device
- I use the library-computer
- I use my smartphone
- I do not attend.
- other: _____
- Which programs did you use for online university during the pandemic?
- Moodle
- Microsoft teams
- ZOOM

- Skype
- other: _____

- How well were you able to manage this model of studying?
 - 1 (bad)
 - 2
 - 3 (not good, not bad)
 - 4
 - 5 (very good)

- Where your professors educated to use this model of classes?
 - 1 (bad)
 - 2
 - 3 (not good, not bad)
 - 4
 - 5 (very good)

- How much did you enjoy online classes during the pandemic?
 - 1 (bad)
 - 2
 - 3 (not good, not bad)
 - 4
 - 5 (very good)

- How do you rate your study efficiency during the online classes during the covid-19 pandemic?
 - more efficient than during times of in person classes
 - unchanged
 - less efficient than during times of in person classes

- Do you think the methods of knowledge assessment were unethical in the model of online classes?
 - Yes
 - No

- Did you feel lonely or isolated without in person classes?
 - I felt lonely or isolated, because of online classes.
 - I felt the same as during in person classes.
 - I felt less lonely or isolated during online classes, than during in person classes
 - I did not feel lonely or isolated because of online classes

- How did you keep in touch with your classmates during the pandemic?

Through social media.

Outside (walks)

In private apartments

I did not keep in touch with my classmates during the pandemic.

other: _____

- Did your study habits change, because of the online classes during the covid-19 pandemic?
 - Yes, I studied better
 - unchanged
 - I studied worse than before the pandemic

- What were the reasons for better studying?
 - I did not study better
 - more flexible time management
 - classes were easier reachable (e.g., you live far from the university)
 - easier access to learning materials
 - class interactivity
 - comfortable surrounding
 - ability to record meetings
 - other: _____

- What were the reasons for worse studying?
 - covid-19 unrelated
 - technical problems
 - lack of self-discipline
 - social isolations
 - reduced interaction with the professors
 - no access to the necessary program(s)
 - financial struggle due to the covid19 pandemic
 - health problems due to covid19
 - family problems due to covid19
 - worse work/life balance due to covid19
 - other: _____

- Please, write down the most common problems you met.

- Did you miss in person classes during the pandemic?
 - Yes
 - No
- Would you like to keep classes online when the pandemic ends?
 - Yes
 - No
 - Some subjects
 - other: _____
- One advice for Your professors regarding online classes:

ACCEPTANCE OF NEW TECHNOLOGIES IN IP MANAGEMENT. THE USE OF MOODLE PLATFORM WITHIN CONTEXT OF MUPIC PROJECT

Broz Lofiego, Adrián
Florida Universitària, Spain
abroz@florida-uni.es

Abstract. In a context of accelerated change, where new technologies have become an essential ally, university education with an international profile turn to be a critical factor in the learning process. Aware of the changes experienced within the educational paradigm and the interrelation between new technologies and soft competences, Florida Universitària together with three other European universities have joined forces for a period of three years to participate in the MUPIC Project, using the MOODLE platform as a learning tool. The aim of this paper is to share the experience of an innovative project, which includes the evaluation of the pedagogical tools available to students, as a motivating option for the learning process. Based on the description of a technological tool, the Moodle platform, a model is proposed to explain the intention to use and the effective use of this technology. Within the evaluation of inhibitors and promoters, we intend to study the role of hedonic motivations, which some authors associate with technological happiness. Based on the proposed model, steps will be suggested for the empirical testing of its hypotheses, as well as suggesting other variables that may influence technological acceptance.

Key words: *Technological Acceptance and Diffusion; Hedonic Motivations; MOODLE; Virtual Environments; Multidisciplinary and Multicultural Projects.*

1. Introduction

Understanding the acceptance and use of a technology is one of the most mature and fruitful streams of research in information and communication systems. When faced with the question of why people adopt or reject an innovation, there are several models aimed at providing a comprehensive explanation. Research has been primarily motivated by the belief that the use of new technologies improves performance, increases well-being and happiness, enhances self-efficacy, decreases anxiety, and increases productivity (Venkatesh et al., 2003; Venkatesh et al., 2007; Venkatesh et al., 2012; Venkatesh et al., 2016; Tamilmani et al., 2019; Tamilmani et al., 2021).

In a context of accelerated change, where new technologies have become an essential ally, university education with an international profile turn to be a critical factor in the learning process. Aware of the changes experienced within the educational paradigm and the interrelation between new technologies and soft competences, Florida Universitària together with three other European universities have joined forces for a period of three years to participate in the MUPIC Project, using the MOODLE platform as a learning tool.

The aim of this paper is to share the experience of an innovative project, which includes the evaluation of the pedagogical tools available to students, as a motivating option for the learning process. Based on the description of a technological tool, the Moodle Platform, a model is proposed to explain the intention to use and the effective use of

this technology, which has allowed the MUPIC Project to become an innovative, motivating, meaningful and happiness-generating learning experience.

Within the evaluation of inhibitors and promoters, we intend to study the role of hedonic motivations, which some authors associate with technological happiness. Based on the proposed model, the steps to carry out the empirical testing of its hypotheses will be suggested, as well as other variables that may influence technological acceptance. This paper is organized as follows: in Section 1 we introduce the main characteristics of the MUPIC Project, and we describe the technological tool used, the MOODLE Platform. In Section 3 we analyse new technology acceptance models in perspective, doing especial emphasis on the UTAUT2 model. In Section 4 we make the research proposal to analyse the intention to use and the effective use of the MOODLE Platform within the MUPIC Project. Finally, in Section 5 we show main conclusions.

2. Main features of MUPIC Project & the MOODLE Platform

In recent decades, because of the accelerated development of ICTs and globalisation, higher education has been forced to undertake profound changes to meet the needs of a more sophisticated and interdependent labour market (Alcón-Soler, 2011). In a context where the emphasis in the educational process has shifted from teaching to learning, students have been forced to learn actively and continuously, developing new competences and greater autonomy (Ponsa et al., 2015).

Aware of these changes in the educational paradigm and the importance of generic competences (also called soft or transversal), Florida Universit ria (FLU) together with the University of West Bohemia (UWB), Turku University of Applied Sciences (TUAS) and Universit  de Mons (UM) have partnered to participate in the Multidisciplinary Projects in an International Context (MUPIC).

MUPIC, which focuses on undergraduate and postgraduate studies in mechanical engineering, industrial design, business administration and management and marketing, has been conceived in two ways:

- a. A formative program, consisting of the development of an online course, composed of five modules: intercultural communication, online communication and virtual teams, industrial design, project management and strategic management. Through these courses, students of mechanical engineering, project management, business and marketing and industrial design acquired and/or enriched professional competences necessary for their professional and working life.
- b. A practical program, based on finding solutions to certain challenges posed by partner companies (Skoda Transportation, Engel, Vesuvius and Desimone).

During the first year, all partners involved in the project developed an online course, defined the objectives, and expected results, structured the measurement and evaluation tools, and created a glossary. In the second year, the specially selected students were divided into multidisciplinary and multicultural groups, who, working face-to-face and virtually, oversaw finding and/or creating a product and/or solutions to the challenges proposed by the partner companies. In the third year, the process was restarted with new students, groups, companies, and challenges.

Each team has had students from different disciplines and has developed/enrich skills related to cooperation, intercultural communication, teamwork, conflict resolution, negotiation, innovation, creativity, leadership, and ethical commitment. Throughout the

period, those competences acquired by the students were evaluated by the partner universities and companies, using various significant instruments. The expected result of the project was that the students found solutions to the proposed challenges based on the use of previous technical knowledge and professional and soft competences worked during the whole process.

The MUPIC Project has brought several educational innovations such as:

- Blended and flipped learning model,
- Higher level of digital and linguistic competences,
- Development and enrichment of soft competences,
- Greater understanding of European and global social, ethical, linguistic, and cultural diversity, and,
- Increased support for internationalisation and mobility processes.

Within the MUPIC project a total of six work packages (WP) were defined comprising:

- *WP1 Project Management*, carried out by UWB.
- *WP2 Project Development*, by TUAS.
- *WP3 Piloting*, by TUAS.
- *WP4 Evaluation of the project and students*, by Mons.
- *WP5 Dissemination*, by UWB.
- *WP6 Exploitation and Sustainability* by FLU.

In addition, several intellectual outputs (IO) and their responsible institutions were defined. Although each package has a responsible institution, all university partners work on each of them.

- *IO1. Five e-learning modules*: M1 Intercultural Communication, M2 Online Communication and Virtual Teams, M3 Industrial Design, M4 Project Management and Marketing and Business. UWB.
- *IO2. Glossary of terms*: engineering, industrial design, and project management) in English, French, Spanish, Finnish and Czech by the UWB with the help of the other partners.
- *IO3. Teachers' Guide*. FLU.
- *IO4. Development of assessment and performance measurement tools*: Assessment Grid. FLU.
- *IO5. Course curriculum* by TUAS.
- *IO6. Research and Publication*. All partners.

Within the communication tools, the MUPIC Moodle Platform was developed and enabled in the framework of the project. The structure of the platform was focused on dividing the two pilots carried out (Pilsen and Mons) and included all the activities developed, the deadlines, the challenges of the companies, the learning modules and all the intellectual outputs: a glossary, an assessment grid, the teacher's guide, and the project presentations, among others. Students were also able to upload intermediate and final reports and partial and final presentations.

Moodle also reported the schedule of activities, sent the relevant alerts, and allowed communication between participating teachers and students. However, in the quality

evaluations carried out within the project, the assessment of Moodle satisfaction was lower than for the rest of the items analysed.

For this reason, it would be interesting to understand the intention to use and the effective use of the platform and its drivers and inhibitors. To this end, we propose an empirical research based on the UTAUT2 model, which also includes some additional variables to enrich explanations.

3. New technology acceptance models in perspective: the UTAUT2 model

Understanding the acceptance and use of a technology is one of the most mature and fruitful streams of research within information and communication systems (Venkatesh et al., 2012; Venkatesh et al., 2016; Tamilmani et al., 2019; Tamilmani et al., 2021)

Faced with the question of why people adopt a new technology, there are a number of theoretical models aimed at providing a comprehensive explanation, such as the Diffusion of Innovations Theory (Rogers, 2003), the Theory of Reasoned Action (Fishbein and Ajzen, 1975), the Innovation Resistance Model (Sheth, 1981), the Theory of Planned Behaviour (Ajzen, 1985), the Technology Acceptance Model (Davis, 1986), the Computer Utilisation Model (Thompson et al., 1991); the Motivational Model (Davis et al., 1992), the Decomposed Theory of Planned Behaviour (Taylor and Todd, 1995), the Social Cognitive Theory (Compeau and Higgins, 1995), the Technology Acceptance Model 2 (Venkatesh and Davis, 2000), the Unified Theory of Technology Acceptance and Use (Venkatesh et al., 2003; Venkatesh et al., 2016), the Technology Acceptance Model 3 (Venkatesh and Bala, 2008) and the Unified Theory of Technology Acceptance and Use 2 (Venkatesh et al., 2012; Venkatesh et al., 2016).

These theoretical models have been developed based on different perspectives, including social psychology, sociology, anthropology and the study of information and communication systems (ICS). All these disciplines have been brought together to explain the general conditions by which people intend to adopt or reject a technological innovation and how this intention translates into a particular behaviour and/or the repetition of that behaviour (Al-Qeisi, 2009). Over more than fifty years of research, multiple analyses have been conducted across different technologies, tasks, times, locations, users (individual or organisational) and contexts of use, both voluntary and compulsive (Venkatesh et al., 2016).

In general, models developed within information systems have tried to explain the reasons why some technologies receive rapid acceptance, while others are not accepted or are even rejected. There is some cognitive dissonance within the research group in those cases where a technology does not reach reasonable levels of acceptance or is even rejected, even though it demonstrates technical superiority to alternatives available to users (Venkatesh et al., 2012; Venkatesh et al., 2016).

The large body of existing theory and research that has given it substance over the past six decades has been motivated primarily by the belief that the use of information and communication systems and the adoption of new technologies improve individual performance, enhance well-being, increase self-efficacy, and decrease anxiety. Furthermore, in cases where adoption corresponds to the use of technology in corporate settings, it is argued that the use of technology increases employees' productivity at work and, consequently, improves organisational performance and is a source of competitive advantage. In turn, to the extent that a technology improves a

person's quality of life and performance, a user's satisfaction increases (Binde and Fuksa, 2013).

Technology acceptance models developed in recent decades have provided a robust theoretical framework for analysing how and why people voluntarily and individually make the decision to adopt, use and/or re-use a particular technological innovation.

The introduction of the Unified Theory of Acceptance and Use of Technology (UTAUT) at the beginning of this millennium by Venkatesh et al. (2003) provided answers to many of the questions raised in the discipline. With its appearance in 2003, the authors of the UTAUT integrated previous theoretical developments, which were fragmented and diffuse, into a model that combined them in a harmonious and integrated way. The UTAUT, which is a synthesis model of the literature on information and communication systems, provides a comprehensive explanation of technology adoption within organisations, considering all previous research perspectives. Moreover, and this is not a minor issue in view of what has been described in the preceding paragraphs, the UTAUT has a high explanatory power, even if it suffers from a certain simplicity.

Years later, Venkatesh et al. (2012) conducted a thorough review of the existing literature on the UTAUT model, analysing more than 500 papers on the evolution of the model and its various extensions. In this review, the authors concluded that, although the advances in research had been very relevant, many of the theoretical approaches consulted included variables aggregated in an ad hoc manner, without taking much care of the context of study of the technologies, particularly regarding those used at the individual consumer level.

According to Venkatesh et al. (2012), "in the case of UTAUT, which was originally developed to explain the acceptance and use of technologies within organisations, it is critical to examine how this model can be extended to other contexts of use, such as consumer technologies, a multibillion-dollar industry given the number of technology devices, applications and consumer-facing services" (p. 158).

To analyse technology acceptance at the individual consumer level, Venkatesh et al. (2012) introduced the UTAUT2 model, which required the conversion of some variables from the original model and the inclusion of other relevant variables, but without losing the essence of the originally formulated model.

The UTAUT 2 model is structured around 7 core constructs, performance expectancy, effort expectancy, social influence, facilitating conditions, hedonic motivations, price-value relationship, and habit, to which are added a series of moderators comprising age, gender and, experience (Figure1). According to Tamilmani et al. (2021) the extended unified theory of acceptance and use of technology (UTAUT2) has already garnered more than 6000 citations with extensive usage in information systems and beyond, being a robust theory on most dimensions except for parsimony arising from the complex model.

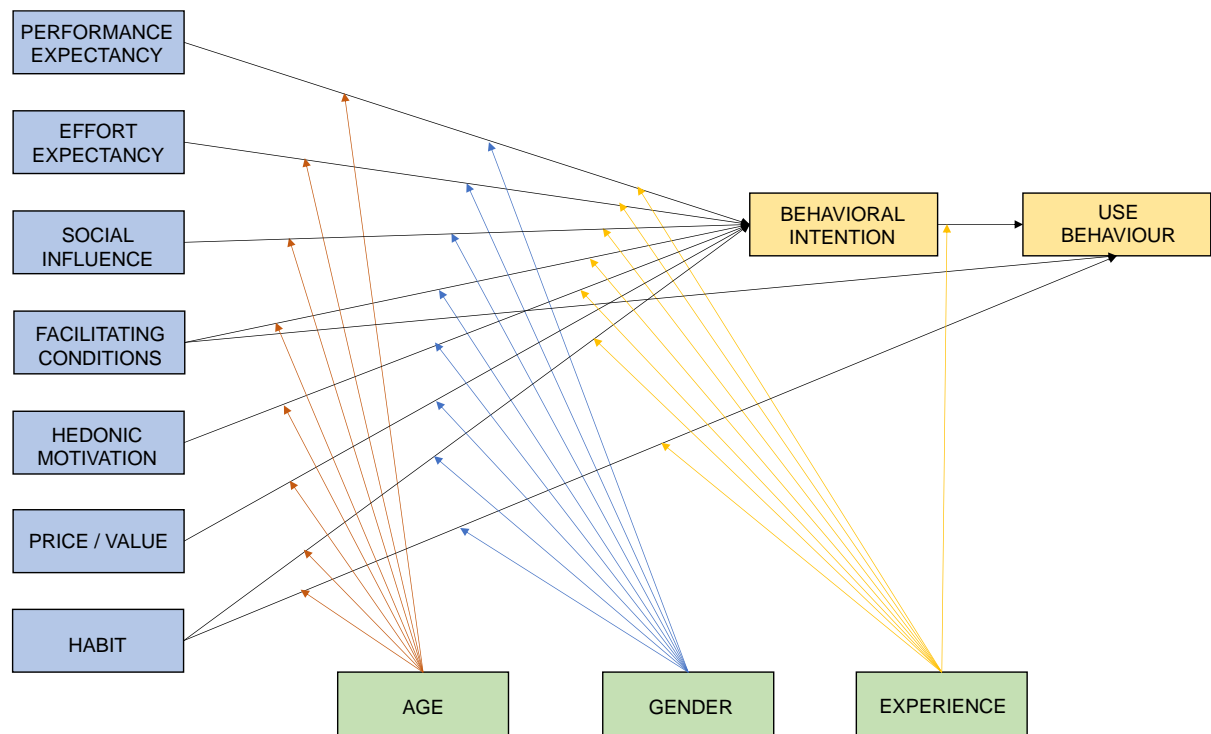


Figure 1 The UTAUT2 Model
Source: Venkatesh et al. (2012).

Table 1 Main constructs of the UTAUT2 Model.

Performance Expectancy	Is defined as “the degree to which using a technology will provide benefits to consumers in performing certain activities” (Venkatesh et al., 2012; pp. 159).
Effort Expectancy	Is “the degree of ease associated with consumers’ use of technology” (Venkatesh et al., 2012; pp. 159).
Social Influence	Is “the extent to which consumers perceive that important others (e.g., family and friends) believe they should use a particular technology” (Venkatesh et al., 2012; pp. 159).
Facilitating Conditions	Refer to “consumers’ perceptions of the resources and support available to perform a behaviour” (Venkatesh et al., 2012; pp. 159).
Hedonic Motivations	Is defined as “the fun or pleasure derived from using a technology”. (Venkatesh et al., 2012; pp. 161).
Price / Value	Is defined as the “consumers’ cognitive trade-off between the perceived benefits of the applications and the monetary cost for using them” (Venkatesh et al., 2012; pp. 161).
Habit	Refers to “the extent to which people tend to perform behaviours automatically because of learning” (Venkatesh et al., 2012; pp. 161).

Source: Venkatesh et al. (2012).

Within these variables, there is one that plays a prominent role, hedonic motivations, which is often associated with what is called "technological happiness". Some authors argue that the inclusion of hedonic motivations is important for the use of a technology, so that their inclusion will increase utility and thus performance expectancy. Hedonic

motivations derive from consumers' innovation traits and consumers' search for novelty, which is a source of enjoyment and complacency. In the context of consumers, hedonic motivations, also referred to as "perceived enjoyment", have been found to be, along with habit, two of the most important predictors of technology use and adoption (Venkatesh et al., 2012). Raman et al. (2022) show that intrinsic motivation influenced behavioural intention to use Moodle Platform while Tamilmani et al. (2019) find that around 60% of empirical studies in technology acceptance use this variable as a significant construct.

4. The research proposal on the intention to use and the effective use of the MOODLE Platform within the MUPIC Project

Based on the literature review we propose to carry out empirical research among students and teachers to assess the influence of UTAUT2 variables in the adoption of MOODLE Platform. Questionnaires will be self-administered and before answering, participants will be given access to the MOODLE platform to test all aspects including the evaluation of usability variables. The research will take place in the first semester of 2022 and will include undergraduate and postgraduate students and teachers from the universities participating in the MUPIC project.

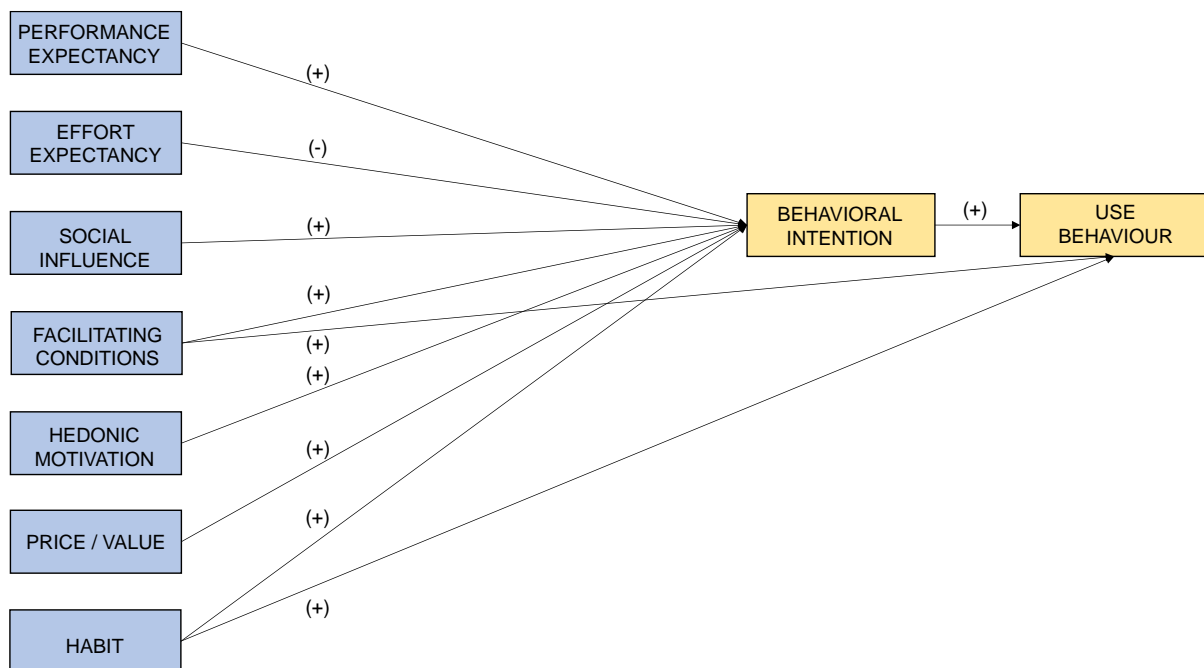


Figure 2 Base Model for the MOODLE Platform Acceptance Study
Source: Venkatesh et al. (2012).

To create a holistic model, which takes into consideration the contexts of use of a technology as well as the characteristics of the users and at the same time does not lose its simplicity, a reasonable option is to extend the UTAUT2 model with variables that directly and indirectly influence adoption and represent the casuistry of that technology.

Taking into consideration the recommendation of Venkatesh et al. (2012) and Venkatesh et al. (2016), the UTAUT 2 model can be significantly enriched by

integrating it with other perspectives, using new endogenous and exogenous mechanisms, new moderators, and new outcomes, as well as by applying it in new analytical contexts.

Depending on the prevailing conditions, other aspects such as usability, technological readiness and anxiety, risk and trust, attractiveness of alternatives and the differential profile of the tool under study are also considered.

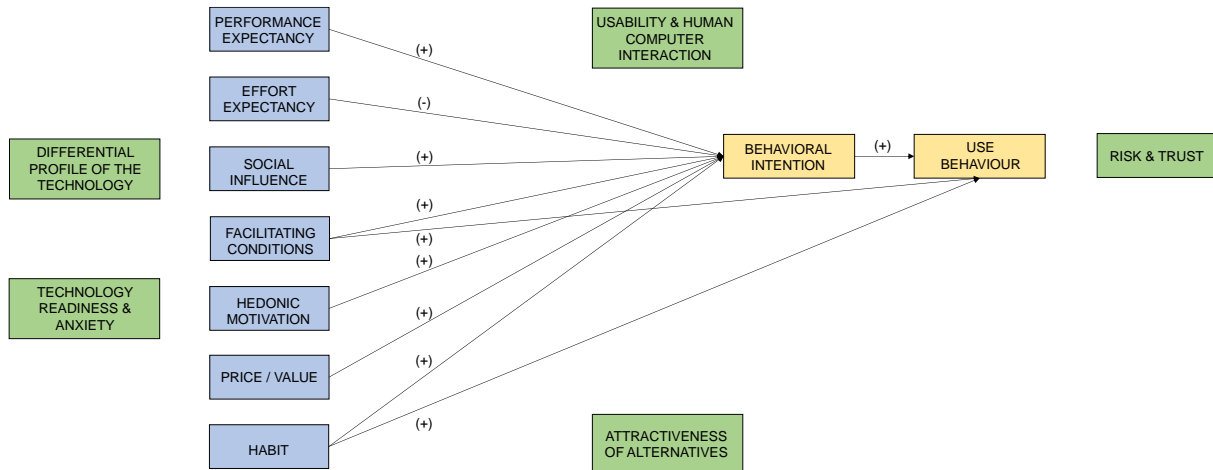


Figure 3 Enriched Model for the study of the MOODLE Platform within MUPIC.

Source: Venkatesh et al. (2012).

5. Conclusions

MUPIC is the result of the combination of several innovative aspects in the construction of the student's curriculum, and its distinctive features are the following:

- It employs reverse pedagogy methodologies and constitutes a form of blended learning (virtual and face-to-face learning).
- It uses "problem-based learning" (PBL) to achieve a more involved and motivated student body.
- It encourages teamwork and collaborative learning.
- Helps socialisation and promotes understanding of multicultural and multidisciplinary differences.
- Increases initiative, leadership, innovation, creativity, communication, and individual and collective feedback.
- Contributes to lifelong learning, written and oral communication in English and in the use of ICT.
- Increases the playful aspect of the learning process.
- Incorporate ethical discussion within the curriculum.

However, satisfaction with the use of the communication tool is lower than the levels of satisfactions achieved with other dimensions of MUPIC Project. For this reason, a model is proposed to explain the acceptance and use of this technology, allowing us to find those inhibitors and drivers that allow for an improvement in this type of project.

The proposed model is based on the UTAUT2, where hedonic motivations play a special role; the pleasure and satisfaction derived from the use of a new technology.

The possibility of incorporating other aspects that contribute to the formation of a holistic model is also foreseen. Finally, it will be sought to determine whether in this type of technology, hedonic motivations are the strongest predictor of the intention to use and the effective use of a technology.

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DISTANCE LEARNING DURING THE COVID-19 PANDEMIC STUDENTS PERCEPTIONS FROM A POLYTECHNIC INSTITUTE IN PORTUGAL

Vitor Roque

Polytechnic of Guarda, Guarda, PORTUGAL
vitor.roque@ipg.pt

Joaquim Mateus

Polytechnic of Guarda, Guarda, PORTUGAL
jmateus@ipg.pt

Joaquim Brigas

Polytechnic of Guarda, Guarda, PORTUGAL
joaquimbrigas@ipg.pt

Abstract. According to UNESCO, it is estimated that the education of more than 220 million higher education students was suddenly disrupted in 2020 by university closures due to COVID-19. The pandemic forced the transition to emergency online learning formats that have amplified the use of digital platforms in the support of learning and have given rise to various strategies of digital learning that were previously little known, little used, or even non-existent. With this study, we sought to evaluate the perceptions of the students of Polytechnic of Guarda on the changes in the teaching-learning process due to the COVID-19 pandemic, regarding online learning.

Key words: COVID-19; Higher Education; Lockdown; Online Learning; Polytechnic of Guarda

1. Introduction

The critical enabling role of Information and Communication Technologies (ICT) for the society was highlighted in 2010 when the European Commission defined that the Digital Agenda for Europe is one of the seven flagship initiatives of the Europe 2020 Strategy (European Commission, 2010). ICT has played a leading role in developing various sectors, such as industry, health, and education.

Numerous changes have occurred in the social, political, economic and technical-technological life of people during the COVID-19 pandemic. In order to reduce the spread of the pandemic, Governments around the world have implemented measures such as the shutting down of schools, colleges and universities for an indefinite time, and the transition to online education was implemented (Bozkurt & Sharma, 2020; Chick et al., 2020; Rodriguez-Segura et al., 2020; Yan, 2020; Zhang et al., 2020), requiring students, as well as professors, to have a satisfactory level of computer knowledge (Mishra et al., 2020).

Following the implementation of the emergency measures, online learning has become a necessary strategy for adequate teaching in this period of the pandemic (Batez, 2021). Online tools were used for different educational purposes: connecting educators and learners with each other when in separate locations; accessing information and environments not usually available in every home or institution; and supporting

continued professional development of educators in a flexible way (Aziz et al., 2020; Bozkurt & Sharma, 2020; Rodriguez-Segura et al., 2020; Yan, 2020).

Although there is widespread adoption of ICT within the Higher Education Institutions (HEI) ecosystem studies show that there is some difficulty in establishing a complete list of what is used, where and in which contexts (Aziz et al., 2020). When looking at our own HEI, the Polytechnic of Guarda (IPG), it is easy to understand that the list of ICT used included: learning management systems, social media platforms, blogging platforms, discussion forums, wikis, cloud computing services for applications or storage, augmented reality, virtual reality and mixed reality technologies. This wide array of technologies and contexts of use in higher education scenarios is simultaneously an advantage and a disadvantage for all the parties involved.

In Portugal, the first state of emergency was declared in March 2020, and during the second semester of the 2019/2020 academic year, universities suspended face-to-face classes, which were converted to online classes. Students had to adapt in record time, to this new type of classes using the online tools available at each institution. This type of education was characterized by the physical division between the student and the professor, as well as the strengthening of the use of ICT tools as mediators of the teaching-learning process (Otsuka et al., 2011). All the students, whether or not they were familiar with the available digital learning platforms, had to use them immediately after the suspension of face-to-face classes. Without these platforms it would have been impossible to maintain the classes during the pandemic lockdown.

This paper presents the results of an online questionnaire that collected 293 responses from IPG students. It aimed to assess the perceptions of IPG students about the changes occurred in learning related activities during the COVID-19 pandemic lockdown.

1.1. The Polytechnic of Guarda

The Polytechnic of Guarda (IPG) is an institution of higher education dedicated to preparing students for their future professions (Figure 1). It is also involved in research activities, services to the community and cultural, scientific and technical interchange. The Polytechnic was founded in 1980 and its statutes were confirmed in 1985. The Higher School of Education began in 1986 and one year later, the Higher School of Technology and Management. In 1999, the Higher School of Tourism and Hospitality Management was founded, followed, in 2001, by the integration of the Higher School of Health Sciences (IPG, 2022). Nowadays, the IPG is made up of four schools:

- The School of Education, Communication and Sport (ESECD);
- The School of Technology and Management (ESTG);
- The School of Tourism and Hospitality Management (ESTH);
- The School of Health Sciences (ESS).



Figure 1 Guarda and IPG location in PORTUGAL

2. Methods

2.1. Ethical consideration

The study obtained ethical approval from the Polytechnic of Guarda Ethical Committee (Registry nº 9/2020), and General Data Protection Regulation was followed. All participants gave their informed consent before participation, and all data were treated anonymously.

2.2. Sample, data collection, and analysis

A cross-sectional study was conducted in IPG about online learning during the first COVID-19 lockdown. The inclusion criteria were to be a higher education student from the IPG. A convenience sample was gathered and included all students that answered to the questionnaire between May 4 and June 24, 2020.

After a literature review, a questionnaire was designed to collect data about the perceptions and experiences of IPG students concerning online learning during the COVID-19 pandemic. The content of the initial draft of the questionnaire was validated by three professors from different scientific areas. Based on their feedback, the questionnaire was revised to improve the accuracy, terminology, completeness, and meaning of items (Alumran et al., 2012; Yaghmaie, 2003).

After the validation of the content, a pre-test with seven students was conducted.

The questionnaire consists of 3 sections, the first on sociodemographic data, the second on the suspension of classroom activities, with a focus on the institutional

communication and disclosure of information to the students, and the third on online teaching platforms and applications.

The questionnaire was carried out by using Google Forms, an online questionnaire platform. Later on, a hyperlink generated from the system was disseminated through e-mail to the students. Using online data collection has various advantages, namely, data can be collected in a short response time, reduced cost, effortless to entry data, and adjustability of format (Granello & Wheaton, 2004).

A descriptive analysis of the data was made, and all data were treated as aggregated data and not as individual data.

3. Results

In the 2019/2020 academic year, 3547 students were enrolled in the 4 higher schools of IPG of which 1705 (48,07%) were female and 1842 (51,93%) male (PORDATA, 2021).

The questionnaire was fulfilled by 293 students. All the answers, were considered valid and suitable for further analysis.

3.1. Demographic characteristics

Concerning the demographic characteristics, most respondents were from the ESTG (N=100; 34,13%) and females (N=197; 67,24%) (**Error! Reference source not found.** 1). The predominant ages were 18 to 24 years (N=258; 88,05%) (Table 2).

Table 1 Demographics of the sample (students' number by school and gender)

	IPG SCHOOLS									
	ESTG		ESECD		ESS		ESTH		TOTAL	
	N	%	N	%	N	%	N	%	N	%
Female	61	61,00%	52	69,33%	51	80,95%	33	60,00%	197	67,24%
Male	39	39,00%	23	30,67%	12	19,05%	22	40,00%	96	32,76%
TOTAL	100		75		63		55		293	

Table 2 Demographics of the sample (students' number by age)

	IPG			
	Female		Male	
	N	%	N	%
[18-24]	178	60,75%	80	27,30%
[25-34]	11	3,75%	10	3,41%
[35-44]	4	1,37%	5	1,71%
[45-54]	2	0,68%	1	0,34%
[55-64]	1	0,34%	0	0,00%
+65	1	0,34%	0	0,00%

Concerning the course of study, the majority of students stated that they were undergraduate students (N=286; 97,61%). The remaining students were from integrated masters and Higher Professional Technical Courses (CTeSP).

3.2. Students' perceptions about the suspension of face-to-face classes and institutional information provided

Concerning the perception of the students on the suspension of face-to-face classes due to COVID-19, 90,78% (N=266) answered they agreed with it, and among these students, 79,32% (N=211) stated that the suspension was timely. Nevertheless, 45 students (16,92%) stated that the suspension of the face-to-face classes was late.

Regarding the share of information by IPG on COVID-19, most students (N=272; 92,83%) stated that they had been informed.

Due to the lockdown period, knowing the channels used by the IPG to communicate with its students was very important. The students indicated the Institutional Website (N=170; 35,20%) was the channel most used by IPG to communicate with them, followed by email (N=165; 34,16%). Surprisingly, the social networks Facebook (N=78; 16,15%) and Instagram (N=41; 8,49%) appear only in the third and fourth positions as channels used by IPG to inform about the actions related with the COVID-19 pandemic (Figure 2).

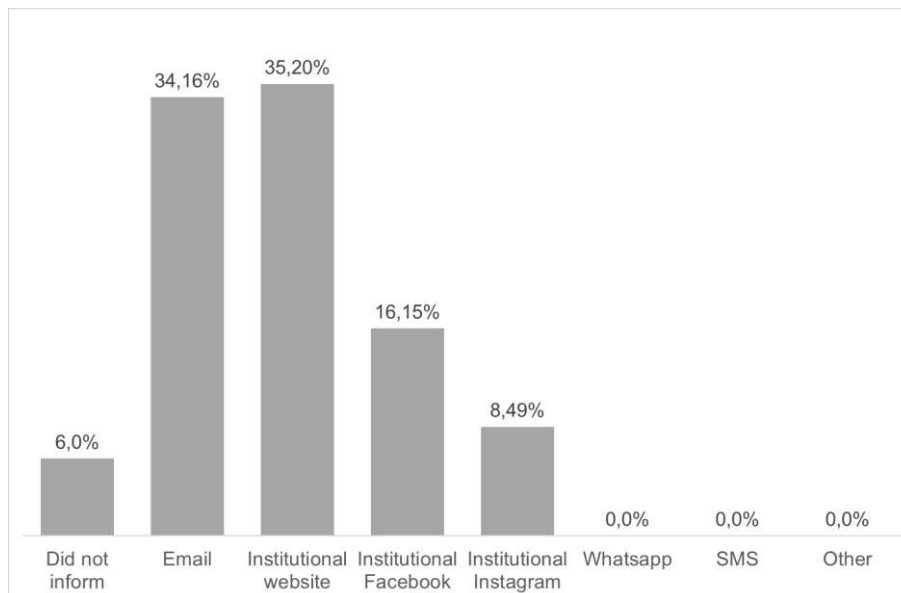


Figure 2 Communication channels used by IPG to communicate with their students

3.3. The use of online platforms or applications for distance learning on COVID-19 outbreak

An E-learning platform is an integrated set of interactive online services that provides trainers, learners, and others involved in education with information, tools, and resources to support and enhance educational delivery and management (European Commission, 2021; SAP, 2020; UNESCO, 2021a, 2021b; Wang et al., 2020; Wikipedia, 2021). They allow professors and/or students to plan their learning processes and collaborate with each other through the exchange of information and knowledge.

Regarding the use of E-learning platforms in IPG before the suspension of the face-to-face classes, most of the students (N=246; 83,96%) have answered they did not use it. Only 16,04% of the students (N=47) answered affirmatively. The most selected

platform, in this case, was MOODLE but with a very low value (N=24), followed by ZOOM (N=15), a cloud-based video conferencing service.

After the suspension of the face-to-face classes, the usage of online platforms or distance learning applications was reinforced. Two hundred eighty-five students (97,27%) stated they use online platforms or distance learning applications, and the online platform most used after the suspension of the face-to-face classes was ZOOM (N=283; 96,59%).

Much of the success of students depends on the conditions they have to study. One of the situations that aggravated the differences between the students was the inequality of resources they had to obtain an online performance that would allow them to succeed in the end (Beunoyer et al., 2020; Bergman & Iyengar, 2020; Gonzales et al., 2020; National Conference of State Legislatures, 2021). In this sense, an evaluation was carried out to determine if the students had the necessary conditions and resources to attend the online classes. Regarding this, most of the students stated they have the necessary conditions and equipment (Table 3).

Table 3 Students' conditions and resources to attend online classes

CONDITIONS AND RESOURCES	N	%
Internet access	284	96,93%
Own computer	261	89,08%
Shared computer	27	9,22%
Calm and private place	169	57,68%
Online resources (articles, books, videos, etc.)	178	60,75%
Video conference	238	81,23%
Instant messaging	131	44,71%
Email	257	87,71%
Camera	210	71,67%
Microphone	230	78,50%
Smartphone	225	76,79%
Tablet	51	17,41%

The main advantages of online learning (Table 4) pointed out by students were “There is no need for displacements/travelling” (N=196; 66,89%) followed by “Flexibility of the workplace” (N=196; 57,68%).

Table 4 Advantages of online learning

ADVANTAGES	N	%
Improves effectiveness compared with face-to-face classes	14	4,78%
Increases self-confidence	8	2,73%
Increases the sense of responsibility	88	30,03%
Allows the use of metrics (for instance students attendance)	51	17,41%
Flexibility of the workplace	169	57,68%
Allows the use of different types of contents in digital format	65	22,18%
There is no need for displacements/travelling	196	66,89%
Reduces/breaks down barriers between generations	8	2,73%
Decreases stiffness regarding class time and pace	33	11,26%
Recording of the classes and the possibility to rewatch them at another schedule	97	33,11%
Other	0	0,00%

The main disadvantages of online learning pointed out by the IPG students were “Absence of face-to-face interaction between students and between students and professors” (N=182; 62,12%), followed by “Increases difficulty in focusing” (N=169, 57,68%) and “Totally relies on technology” (N=117; 39,93%).

The perception of students about online learning was positive for 40,61% and negative for 43,69% (Figure 3).

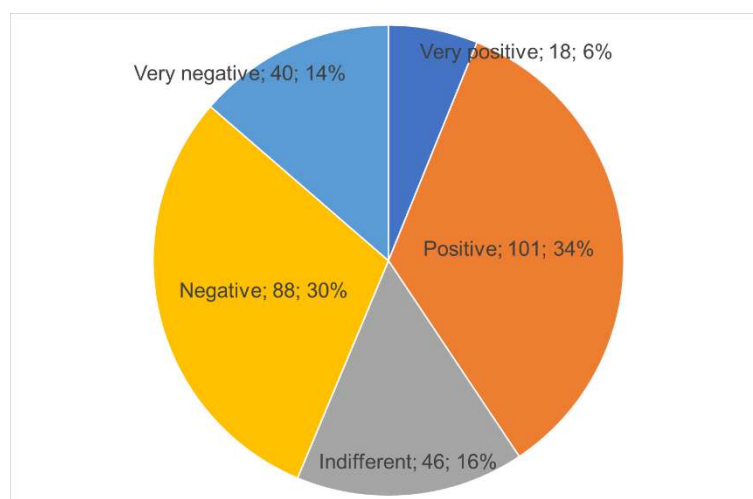


Figure 3 Online learning students' perception

In terms of students' preferences concerning the type of classes, where the options were E-Learning, B-Learning, and Face-to-Face classes, most of the students prefer

the Face-to-Face Classes (N=191; 65,53%), followed by E-Learning²² classes (N=54; 18,43%) and B-Learning²³ classes (N=47; 16,04%).

4. Conclusions

In Higher Education Institutions all over the world, the 2019/2020 academic year will be forever remembered for the constraints brought upon by the pandemic COVID-19, which led to the suspension of face-to-face classes in Higher Education Institutions worldwide. Portugal was no exception, and in March 2020, all HEI moved to an online learning model due to the Portuguese government's lockdown decreed. Being the IPG a HEI, it needed to move, in a record time, to a full online learning model to comply with the rules enacted by the Portuguese government.

The conclusions of this research shows that the IPG students had the necessary conditions and resouces, to attend online classes.

Moreover, this research shows that the main channels used to communicate with the IPG students during the lockdown period were the institutional website of IPG and the email. These results raise some issues for a time when social media are widely used in our daily activities and it seems that IPG is not using these channels in an effective way to communicate with their students. These results are in agreement with those obtained by Almeida (2020) who, in a research involving all Portuguese universities, concluded that the use of social networks by universities is still not very significant.

During confinement, the use of online distance learning platforms or applications was strengthened, with emphasis on the ZOOM application. ZOOM success happened because it allows synchronous classes, meetings, meeting recordings, and ensures student tutoring.

The main conclusion of this research is that most of the IPG students prefer face-to-face classes and in-person contact with colleagues and teachers instead of E-Learning or B-Learning classes.

As a final remark the COVID-19 pandemics should be seen as an opportunity to improve the online learning and teaching processes in the IPG and in general in all the HEI.

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²² Electronic Learning (E-Learning) - Learning done by studying at home using computers and courses provided on the Internet.

²³ Blended Learning (B-Learning) - A way of learning that combines traditional classroom lessons with lessons that use computer.

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BUILDING SOFT SKILLS FOR BUSINESS COMMUNICATION: THE NECESSARY ART OF PERSUASION

Oana Ursu

Alexandru Ioan Cuza” University, Faculty of Economics and Business Administration, Iași,
Romania
surugiu.oana@gmail.com

Abstract. In our fast-paced information-driven world, teeming with data and facts, persuasive skills may be more necessary than ever. Drawing on relevant literature on the topic, we argue that persuasion lies at the core of both our personal life and our professional activity. Persuasive skills are of outmost importance in our daily interactions and in business encounters alike, as we rely on this skill in all aspects of our life in order to reach consensus, close deals, or win concessions, etc. In fact, we could even go as far as to state that persuasive skills may exert much more influence on people’s behaviour than any other form of power or authority. Moreover, as far as business activity is concerned, people often get tangled in company speak (e.g. the overuse of PowerPoint presentations) and, ignoring the critical importance of persuasion, they barely manage to communicate, let alone to inspire their peers. In addition, things complicate even further when communication occurs in a foreign language. Thus, given the fact that persuasion is grounded in basic principles that can be taught, learned and applied, this paper aims to investigate how the principles of persuasion can be turned into rhetorical devices and used in effective (business) communication.

Key words: *Persuasion, Storytelling, (Business) Communication, Business English, Soft Skills.*

1. Introduction

Throughout our professional life (and not only), we often come across situations that urge for the use of persuasion, that is, situations in which we need to exert some degree of influence upon our peers, our superiors, our employees, etc. Globalisation and increased mobility have turned persuasion into one of the instrumental tools of the essential skillset that people need to acquire in order to communicate effectively both in the workplace and in their daily interactions. Persuasive skills may be required in all settings, in everyday communication and in business encounters alike; we rely on persuasion in all aspects of our life in order to reach consensus, close deals, or win concessions, etc. In fact, we could even go as far as to state that persuasive skills may exert much more influence on people’s behaviour than any other form of power or authority.

Comparing persuasion and power, Conger argues that, similarly to the concept of power, persuasion “often confuses and even mystifies businesspeople. It is so complex – and so dangerous when mishandled – that many would rather just avoid it altogether. But like power, persuasion can be a force for enormous good in an organization. It can pull people together, move ideas forward, galvanize change, and forge constructive solutions.” (2008, p. 55) However, as the scholar posits, in order to understand

persuasion correctly, it is necessary to acknowledge that it is much more than a mere process which involves selling or convincing, but rather a complex endeavor to negotiate and learn.

Drawing on a number of definitions put forth in communication research, Perloff (2017) argues that persuasion is a “symbolic process in which communicators try to convince other people to change their own attitudes or behaviours regarding an issue through the transmission of a message in an atmosphere of free choice.” (p. 22). Perloff goes on to explain that persuasion is a symbolic process, which takes time and effort, and in which speaker and recipient are just as important. It is symbolic as it involves, in Perloff’s terms, the use of a symbol – which can take the form of words (e.g. freedom, equality, truth, etc), or a sign/ design (e.g. the cross, the Nike swoosh, etc.) – which functions as a tool that the persuader relies on in order to change minds and attitudes, or shape opinions. In *Public Speaking in a Nutshell*, Ciortescu argues that persuasion encompasses the attempt to hold sway, stating that it is “intrinsic to the ability to influence” (2020, p. 14). Moreover, discussing business practice in particular, she clarifies that this urge is likely to occur at all levels and within a variety of circumstances across the organisation. Therefore, we could argue that persuasion is one of the skills that business students need to acquire in order to be successful in the job market and, later on, in the business sector they will choose to operate in. Not all people are inborn communicators and, most certainly, not all are endowed with persuasive skills. However, the good news is that persuasion is grounded in basic principles that can be taught, learned and applied. Consequently, our paper aims to investigate how the principles of persuasion can be turned into rhetorical devices and used in effective (business) communication. In so doing, and in order to exemplify how persuasive skills can be built, we will rely on a political speech – the Remarks made by Vice President Kamala Harris at the Celebration of America (January 2021). In our endeavour to provide some pointers on how to use rhetoric and persuasion in building effective (business) communication skills, we will rely on three frameworks, namely Aristotle’s theory of persuasion, the Narrative Paradigm (Storytelling), as well as for Cialdini’s levels of human needs addressed through persuasion.

2. Theories of Persuasion

2.1 Aristotle’s Theory of Persuasion

The study of persuasion dates back to Ancient Greece and Aristotle’s *Art of Rhetoric*, and the ideas propounded by the Greek philosopher laid the basis of persuasion research and still hold true in modern times. The theory of persuasion put forth by Aristotle as early as the 4th century BC is still considered to be fundamental to the development of modern-day theories of persuasion and public speaking. Aristotle distinguishes between “artistic proofs” and “inartistic proofs” that the speaker may rely on in order to persuade his/ her audience. While the “inartistic proofs” refer to external factors, such as the physical appearance/ attractiveness of the speaker, and, as such, can hardly be controlled, the “artistic proofs” can be manipulated, altered by the speaker in his/ her endeavour to exert influence upon the audience. The “artistic proofs” identified by Aristotle are the ETHOS, the PATHOS and the LOGOS. The three modes of persuasion consist of “the speaker’s character (ēthos), or rather the audience’s perception of that character in and through the speech; the emotional

disposition of the listeners or what they undergo (pathos) as a result of the speech; and the argument (logos) itself, “by establishing or appearing to establish something.” (Bartlett, 2019, p. 222). Discussing Aristotle’s artistic proofs, Chan also states that the ethos, the pathos and the logos have the power to “take the audience from where they are, to where you want them to be” (Chan, 2019, p. 76.).

Let us now introduce the three artistic proofs described by the Greek philosopher. First of all, Aristotle distinguishes between two layers of the ETHOS, namely charisma and credibility. While credibility can be built, charisma is a much more subtle and subjective attribute, which even takes precedence over any attempt of the speaker to build credibility. In other words, even before the speaker utters any words, the audience has already made assumptions regarding his/ her credibility, assumptions that are based on physical traits such as attire, looks, or other non-verbal cues.

This first layer of the ethos is immediately complemented by the second one, that of the speaker’s credibility. As Wahl and Morris (2022) show, credibility is made up of elements such as the words used, the way in which they are uttered (volume, intonation, etc.), as well as elements that refer directly to the speaker – e.g. the amount of eye contact, whether the speaker is perceived as sincere, or the energy that (s)he conveys to the public. In discussing this issue, Wahl and Morris provide the example of the 2020 presidential elections in the US, analysing various elements of the *ethos* that came out as dominant features of the two candidates. Thus, as the authors show, sincerity and likeability stood out as main features of Biden’s ethos, while competence in economic matters was one of the pillars of Trump’s credibility in the eyes of the voters. Ethos (credibility) is immediately established in Kamala Harris’s speech: “It is my honour to be here. To **stand on the shoulders of those who came before**. To speak tonight as your **Vice President**.”

The second element described by the Aristotelian theory of persuasion is PATHOS. It is the second “artistic proof” that refers to “passions” or emotions, aspects that enable the speaker to connect with the audience. Aristotle identified a number of values that the speaker may resort to in order to appeal to the public, namely *justice, prudence, generosity, courage, temperance, magnanimity, magnificence* and *wisdom*. The speaker is free to choose what value to emphasise in order to be more persuasive.

Vice President Harris’s speech emphasises words like *justice* and *courage* to create a strong effect on the audience: “We not only **dream**. We **do**.”/ “We shoot for the moon, and then plant our flag on it” (recalling the Apollo 11 mission to the Moon), or “We are **bold, fearless** and **ambitious**”. Moreover, recalling landmark moments in the US history, Harris even uses – through repetition – the word *justice*: “In the middle of the civil right movement, Dr. King fought for racial **justice** and economic **justice**.”

The third “artistic proof” identified by Aristotle is that of the LOGOS, understood as the expression of logic and reason, and materialised in the form of syllogisms. In modern times, logical appeal is achieved no longer by means of syllogisms, but by the use of statistics, graphs, charts or images, as tools to support arguments and persuade audiences. Although, mostly due to its nature, the inaugural address chosen as a case in point for the present argumentation does not rely on the modern appeals to logic – present in the form of numbers and statistics – this appeal is carried out through the use of words that recall of scientific proof, namely **scientists, innovators, educators**.

We can thus argue that ethos equals credibility, and it is built and demonstrated by the speaker's intelligence, character, or mastery of the subject matter. Pathos is likely to vary, according to the mood of both the speaker and the audience, because even the audience's reactions are influenced by their own state of mind. Finally, logos is the endeavour to use reasoning, facts and arguments and examples. Therefore, as shown by Aristotle and the researchers and philosophers that followed in his footsteps, the three artistic proofs of ethos, pathos and logos, that is, credibility, charisma, emotional appeal and appeal to reasoning, allow us to better understand the drivers of influence and identify means to persuade audiences. As shown by Chan, while it is difficult to master all three, or, more precisely, while the speech does not necessarily need to tackle all three elements of Aristotle's *Rhetoric*, one should at least be aware of them. A study on a sample of business speeches carried out by Said (2016) revealed that logos is the preferred strategy in business texts; in political speeches, there is marked tendency to appeal to emotion (pathos), a fact also confirmed by the speech chosen for our analysis.

The speech is peppered with repetitions, which, as shown by Rank (1976, p. 41) in his model of persuasion, are likely to capture attention and intensify persuasion. The speaker also draws on **intensification**, a strategy which is most often instrumented through repetition and which aims at presenting information in a way that reinforces the audience's attention. Marble Chan posits that "successful persuasion requires one to have the skills to assess, analyse, evaluate and create various communication strategies in different situations and to use the key language features to achieve this purpose." (2019, p. 76) Chan identifies two fundamental components, namely "content words" (which carry specific meanings) and "grammatical words" (that express functional or structural relationships). Intensification occurs here through the repetition of words and phrases ("**In the middle** of the Civil War..."; "**In the middle** of the civil rights movement..."; "**keep** refining, **keep** tinkering, **keep** perfecting." "To **believe** in ourselves. **Believe** in our country. **Believe** in what we can do – together."), but also at the level of content words (keep **refining**, keep **tinkering**, keep **perfecting**.", or "building a better life for **themselves**, their **families**, their **communities**").

2.2 Storytelling or the Narrative Paradigm

The second theory of persuasion relied on in the present paper is the Narrative Paradigm, which draws on the work of W. Fisher, put forth as early as 1984. According to Fisher (1989), stories and narratives constitute the most powerful weapon that people may use in order to persuade. Fisher's theory is grounded in a number of basic assumptions, which read as follows: people are inborn storytellers; they tend to use reason in making decisions, and this good judgement is grounded in culture (in its many forms, that is, in history or biography), but also in individual character. Moreover, the "narrative rationality" people make use of is characterised by coherence and faithfulness to the story. Finally, as Fisher argues, the whole world is a book of stories we may relate to when (re)creating our life.

The two fundamental elements of the narrative paradigm – the *narrative probability* and the *narrative fidelity* – render storytelling all the more compelling. *Narrative probability*, which can also be read as coherence, refers to whether or not the story is glued together and free from any inconsistencies. *Narrative fidelity*, which translates into the degree of truthfulness, refers to reliability.

Discussing the instrumental role storytelling plays in persuasion, D. Capras argues that “our brain lights up when we hear a good story” (2021, p. 20). Thus, citing the work of neuroscientists from Princeton University, Capras goes on to state that, apparently, the same areas light up in both participants – listeners and speakers (storytellers). As Capras puts it, storytelling constitutes “an important social glue” (p. 20) and stories are the most persuasive tools one can rely on. Moreover, in order for the story to be most convincing (compelling), it needs to be organised according to a clear narrative framework and, most importantly, it needs to be relatable. You need to get your audience engaged and connected in order to get the message across more effectively and more convincingly. As Davis also shows, “if you need to be more persuasive in the boardroom, in the classroom, or from the podium, a simple story will greatly increase your chances of moving your listeners to action.” (2015/ 04)

Analysing the Gettysburg Address, Tim Davis suggests a framework of analysis in which he identifies *storytelling*, *starting from a place of agreement*, and *articulating a compelling reason* as essential elements for building a persuasive message. From this point of view, Vice President Harris’s speech bears resemblance to the Gettysburg Address, one of the best examples of oratory and persuasion.

Firstly, even if it does not tell a story *per se*, Harris’s speech does give that feeling of cosiness that storytelling would give, due to the crumbs of history hidden throughout: “in the middle of the Civil War, Abraham Lincoln saw a better future and built it” or “In the middle of the civil rights movement, Dr. King fought for racial justice and economic justice.” Short and concise, right to the point, the speech recalls the founders of American history, referring back to “the shoulders of those who came before”.

Secondly, Harris’s remarks start from a place of agreement. The plain reference to **American Aspiration**, as well as the highly significant moments in the US history, render the audience to agree with the speaker. Similarly to the Gettysburg Address, when hearing such references, “to nod your head in agreement at those words is a near compulsion” (Davis, *Ibid.*).

Moreover, the replacement of the “I” pronouns with plural pronouns (“we”, “us”, “our”), contributes to building rapport and creating a sense of belonging and togetherness, while increasing the speaker’s status in the minds of the listeners. The speech counts seventeen such utterances. As shown by Pennebaker (2013), the use of pronouns allows the speaker to gain status and positioning and build credibility (build on the ethos). Starting from the premise that pronouns “are the most social of all word categories” and are indeed widely used in conversation, the scholar argues that “People higher in the social hierarchy use first person singular pronouns such as *I*, *me*, and *my* at much lower rates than people lower in status. In any interaction between two people, the person with the *higher status* uses *fewer I-words*. This is not a typo. High-status people, when talking to lower-status people, use the words *I*, *me*, and *my* at low rates. Conversely, the lower-status people tend to use *I-words* at high rates”. (Pennebaker, 2013, p. 164) Furthermore, as shown by Davis, the same strategy is identified in Lincoln’s speech: “He stayed away from I-words and leaned heavily towards we-words, captivating his audience on a subconscious level.” (2015, *Ibid.*)

Finally, Harris’s speech also articulates compelling reason, relying on what Davis calls the “advanced because technique”. Davis’s theory draws on a study by Langer (carried out in the 70s), who argues the use of the word “because” when asking for something

increases one's persuasive powers from 60% to 90%. In the speech chosen as a case in point for the present analysis, the conjunction is implied:

"In many ways, this moment embodies our character as a nation.

[Because]²⁴It demonstrates who we are.

[Because] Even in dark times, we not only dream, we do.

[Because] We not only see what has been, we see what can be.

[Because] We shoot for the moon, and then we plant our flag on it.

[Because] We are bold, fearless, and ambitious.

[Because] We are undaunted in our belief that we shall overcome; that we will rise up. This is American aspiration". (Harris, 2021)

Although the word "because" is not actually mentioned in the vice president's speech, it is understood from context, as it provides arguments in support for the statement "In many ways, moment embodies our character as a nation" – **Why? Because** "It demonstrates who we are", **Because** "Even in dark times, we not only dream, we do." etc. Just as Lincoln's speech, Harris's address not only uses the right words, but it also considers the effect those words would have on the audience, motivating and compelling them.

3. Persuasion in action

The principles of persuasion described above also hold true for the business world. In order to be convincing, in order to motivate interlocutors, a speaker needs to find ways to uncover the audience's internal drivers. Within organisations, people often get tangled in company speak, rely excessively on PowerPoint presentations and, eventually, fail to communicate effectively. Moreover, with the increase in global workforce mobility, English has become the official language of communication, which places additional strain upon the speaker, now forced to be as convincing, as persuasive as possible, in a foreign language.

So, how do we build persuasive messages? First, we need to carefully examine the situation, anticipate the course of events by looking both at the context and situation (we need to ask ourselves what we really intend to achieve), and at the audience (we need to speak the audience's language and, in order to do so, we need to pay close attention to our target audience's demographics, interests, etc.). In order to become better communicators, and in order to compel our audience to action, it is vital to understand their perspective. Furthermore, the message itself needs to be artfully drafted, both in terms of the strategies used – whether conceived to appeal to emotion (pathos), or to reason and logic (logos) – and in terms of structure (how the content is organised).

Cialdini (1993, p. 80) identifies five levels of human needs that are usually addressed through persuasive messages. Listed from the more general to the more specific/ individual ones, these are the following: the physiological needs level (survival), the security needs level (having a house or a job), social needs level (the need to be accepted in society, to belong to a group), esteem/ ego needs level (the need to be respected, fulfilling our "face" needs), self-actualisation needs level (the need to reach our potential or even exceed it, self-improvement). All these needs are inherent in the

²⁴ Our addition.

human nature, but each varies in intensity depending on one's personality. Vice president Harris's speech appeals particularly to the audience's social needs ("our character as a *nation*", "Believe in what *we* can do – *together*", ("building a better life for *themselves, their families, and their communities*"), their physiological needs ("the *parents* who are *nurturing* the *generations to come*"), their security needs ("In everyone, everywhere who is *building a better life* for themselves, their families, and their communities"), but also, very importantly, their self-actualisation needs ("keep *refining*, keep *tinkering*, keep *perfecting*"; "We not only *dream*, we *do*"), drawing on strong vocabulary in order to motivate and compel to action.

Irrespective of the needs they are targeting, persuasive messages can be built by drawing on either a direct or indirect approach, depending on the complexity of the issue in question, but also on the prevailing communication style of the speaker, or that of the audience. Messages constructed based on a direct approach start with the purpose (explaining the main idea), then grow into the context (explaining the situation) and, finally end with the closing. In an indirect approach, the message starts from the context, providing an explanation of the situation (they use a buffer, in Cialdini's terms), narrow down to the purpose, and finally the closing. According to Thill and Bovee (2017), the indirect approach often relies on the "AIDA" structure, i.e. attention, interest, desire and action. Harris's address relies on an indirect approach, starting from the context – with the glorious American history, from the legacy of "those who came before". Equally, it stirs interest and the desire to act according to the high standards set by the actions of "bold, fearless and ambitious" citizens. Finally, it provides a strong call-to-action ("This is what President Joe Biden has called upon us to *summon* now. The *courage to see beyond crisis. To do what is hard. To do what is good. To unite*".) As Thill and Bovee show, the AIDA organisational plan first aims to get the audience's attention by presenting the potential benefits, thus stirring interest. Then, by appealing to either reason or emotion, the speaker should "build" desire and, finally, provide a well-reasoned call for action.

4. Conclusions

Depending on the aims pursued, the persuasion and communication theories discussed above can be taught, learned and successfully incorporated in business discourse. They can be turned into powerful "weapons" of influence and used in order to create convincing business messages since, very often, persuasion is the very last drop that makes the difference between success and failure. Both Aristotle's theory of persuasion and the Narrative paradigm discussed in this paper have proven to be instrumental in the study of effective communication.

In our present-day turbulent world, we could even go as far as to argue that success depends – to a significant extent – on the individual's cognitive flexibility, which is most visible in his/ her ability to persuade, to convince, to influence. In order to become persuasive communicators, students and trainees need to build analysis and assessment skills and, similarly, to acquire a whole array of communication strategies, which they may be required to apply in the various situations throughout their (professional) life. Moreover, they need to be able not only to build and convey strong messages, but also pay attention to how these messages will impact their audiences, and, hence, compel them to take action.

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SOCIAL PRESENCE AND SATISFACTION IN AN ESP CONTEXT DURING EMERGENCY REMOTE ENGLISH LANGUAGE TEACHING

Ivana M. Krsmanović

Faculty of Technical Sciences Čačak, Serbia
ivana.krsmanovic@ftn.kg.ac.rs

Lena Tica

Faculty of Technical Sciences Čačak, Serbia
lena.tica@ftn.kg.ac.rs

Biljana Đorić

Faculty of Technical Sciences Čačak, Serbia
biljana.dojric@ftn.kg.ac.rs

Nataša Gojgić

Faculty of Technical Sciences Čačak, Serbia
natasa.gojgic@ftn.kg.ac.rs

Abstract. As recent research has shown that there is a correlation between Social Presence and student satisfaction, understanding social context in online instruction is of vital importance. Assessing Social Presence emerges as even more important in the COVID-19 conditions when teaching (has) shifted fully online and computer-mediated communication became the sole means of communication and instruction. The objective of the research was to examine students' perceptions of the social context during Emergency Remote English Language Teaching. The sample consisted of N=91 engineering students who attended a course in Business English through the Microsoft Teams application. The study adopted an exploratory research design under the Social Presence theoretical framework, and the data were collected through an online questionnaire. The instrument was adapted from the Collaborative Learning, Social Presence and Satisfaction questionnaire developed by So and Brush (2008) and further adapted by Pritchett et al. (2014). The findings of the research indicate that students expressed overall satisfaction with the teacher's communication conducted through MS Teams and expressed their satisfaction with what they learned in the ESP course, and that there is a positive correlation between these two categories. However, students also felt that they could not build relationships of trust through the CMC, and although they were comfortable communicating with familiar people, CMC messages failed to convey their feelings and emotions.

Keywords: *English for Specific Purposes, CALL, CMC, Emergency Remote English Language Teaching, Social Presence*

1. Introduction

As the world faced the COVID-19 pandemic outburst in 2020, more than 90 per cent of the countries shifted to unplanned remote teaching, fully replacing face-to-face (F2F) instruction with online teaching only. However, despite educators' efforts to ensure continuous education for their students, it is estimated that over 100 million children have faced problems in achieving learning outcomes due to the global education crisis

caused by the pandemic (UNESCO, 2020). What is more, as the pandemic has not been officially announced over, it is likely that instructional changes brought about by the COVID-19 outbreak are here to stay, which might greatly influence learning outcomes on a larger scale. The severity of the consequences suffered by students and education providers is yet to be addressed from various research perspectives so that adequate interventions and adjustments are implemented in case the pandemic prolongs or a potential future crisis emerges. The findings could also help not only anticipate post-pandemic educational outcomes but redefine academic roles and priorities, as the educational sector will never be as it was before the pandemic.

The complexity of the newly-established means of instruction, which differs from traditional “online learning”, has been best illustrated by the necessity to introduce a new term that encompasses the specificity of the process itself. Although there is certain overlapping in both terms, Emergency Remote Teaching (ERT) and “online learning” are not the same: ERT denotes online instruction that is designed and adapted in haste, due to a sudden threat, that was initially intended to be realized “on-site”. More precisely, ERT is defined as “[a] temporary shift of instructional delivery to an alternate delivery mode due to crisis circumstances [...] for instruction or education that would otherwise be delivered face-to-face or as blended or hybrid courses” (Hodges et al., 2020). Similarly, Emergency Remote English Language Teaching (ERELT) is conceptualized as a “situation of ELT during the outbreak of Covid-19” (Hazaea et al., 2021: 208) or as a “crises-prompted remote language teaching” (Jin et al., 2022: ii). Another emerging term is Emergency Remote Language Teaching and Learning (ERLTL) (Jin et al., 2022: iii) but it refers to all languages being taught, not exclusively English.

Due to the nature of the language courses themselves which require constant interaction between teacher and learners, teaching English in the pandemic conditions has been additionally challenging, especially with teaching integrated skills or providing feedback. Choice of the platform for course delivery and CMC appears to be an important decision. With the sudden shift to the online learning environment, the use of Microsoft Teams significantly increased in 2020 across the world. The number of daily users of Teams has doubled during the pandemic, as it increased from 75 million users in April 2020 to 145 million as of April 2021 (Vailshery, 2022). Microsoft Teams is a Learning Management System (LMS) that integrates meetings, files, assignments and other various apps with an aim to create a virtual learning environment for collaborative and stimulating work. As it is acting as a digital hub, Teams provides useful tools for managing both administrative and educational tasks, with the chat available for both synchronous and asynchronous communication. The main app feature is the option to create or join a “team” and add users within so that private groups for collaboration can be established. MS Teams has been massively used in universities, as Microsoft reports that more than 230,000 educational institutions used Teams for remote or hybrid learning in the wake of the Covid-19 pandemic (Swiatecki, 2020) and the number has probably increased by now.

Research showed that teachers perceive MS Teams as a necessary tool to facilitate autonomy in learning (Zamora-Antuñano et al., 2021). Rojabi (2020) investigated 28 EFL students’ perceptions of Online Learning via Teams during the pandemic in Indonesia, focusing on the quality of teacher-student interaction and learning environment. The study revealed that MS Teams is perceived as a supportive learning

environment, equally beneficial for both student-student and student-teacher interactions. However, this research also showed that some students are less confident to communicate virtually due to being unfamiliar with the tool and felt more comfortable with the face-to-face instruction. In another study, Rababah (2020) explored students' attitudes towards the use of MS Teams in EFL learning and found out that the advantages of MS Teams in EFL were convenience, time efficiency and shared learning resources, whereas technical aspects were listed as major MS Teams shortcomings.

However, whereas there have been studies on teachers' attitudes to Microsoft Teams in EFL or ESL (Zamora-Antuñano et al., 2021), students' perception of Teams as an e-environment in ESP has been under-researched (Keshtiarast, & Salehi, 2020; Juanis, 2020). The available studies demonstrate that MS Teams is perceived as a supportive learning environment in the pandemic conditions (Rojabi, 2020; Krsmanović, & Petrović, 2021; Juanis, 2020) which enhances engagement (Poston et al., 2019) and serves as a convenient although technically demanding tool (Rababah, 2020; Krsmanović, & Petrović, 2021). In the ERELT context within ESP courses, recent research suggests that students perceive MS Teams as a desirable e-learning environment for language instruction in the pandemic circumstances, especially emphasizing the possibility of re-visiting the uploaded learning material or recorded online sessions as key features that motivate them to study more efficiently or better prepare for examinations (Krsmanović, & Petrović, 2021). Similarly, MS Teams is reported to facilitate interaction among students, improve their language skills and can be successfully used for assessment (AlAdwani, & AlFadley, 2022). However, the tool also allows students to get easily distracted or make them likely to cheat (Nguyen, & Duong, 2021).

Current studies have showcased that the lack of person-to-person interactions affects the quality of online education and that due to physical separation opportunities for interactions are often limited. Social Presence appears to be a relevant phenomenon that adds to the overall quality of online teaching and learning and is a strong predictor of satisfaction in the CMC environment (So, & Brush, 2008; Tu, 2002; Gunawardena, & Zittle, 1997). The Community of Inquiry framework plays a pivotal role in establishing Social Presence in CMC (Fiock, 2020; Shea, & Bidjerano, 2010), as it nurtures the feelings of connectedness and belonging among learners and fosters collaborative learning. As showcased by So and Brush (2008), students with a high perception of collaborative learning also perceived high levels of Social Presence. Current research has demonstrated that there is a positive correlation between the Social Presence and students' satisfaction with a course, and the Social Presence and the perceived learning (Richardson et al., 2017; Gunawardena, & Zittle, 1997), and that the difference between online and face-to-face Social Presence can affect students' overall satisfaction with the platform (Lowenthal, 2009). However, as a plethora of current research studies explored Social Presence and Computer-mediated Communication in different contexts, the role of Social Presence in Computer-mediated Communication in the context of English for Specific Purposes (ESP), especially in courses conducted through Microsoft Teams has been under-studied.

Having been cognizant of these findings, the purpose of this study is to examine the ways in which undergraduate students of engineering perceive their Social Presence and satisfaction in English for Specific Purposes courses delivered through the

Microsoft Teams platform during the COVID-19 pandemic. The objectives of the research were: 1) to explore students' perception of their Social Presence during the ESP course conducted through MS Teams; 2) to describe students' satisfaction with the ESP course delivered via MS Teams; 3) to assess whether there is a correlation between the Social Presence and satisfaction.

2. Theoretical Background

2.1 Computer-mediated Communication and Community of Inquiry

Computer-mediated Communication (CMC) is a term that refers to human communication via computers (Simpson, 2002). Within CMC as an umbrella term, we can talk about a narrower field of Computer-assisted language learning (CALL) which refers not only to the use of computers in language instruction but "a variety of technology used for language learning" (Chapelle, 2010: 66). As CALL has been utilized in language classrooms across the world for decades now, both students and practitioners have already experienced many CALL advantages and limitations, mainly within a wide range of online courses they had taken or held in the past. However, owning a stable Internet connection and access to apps and platforms does not assure that learning is taking place, but that it takes much more beyond the existing e-environment to integrate interaction and instruction into successful educational experiences. Ideally, teachers and students engaged in online learning should create Communities of Inquiry (CoI) implemented within their e-environments. Shea & Bidjerano (2010: 1723) argued that CoI model is the most precise descriptive model for understanding online learning in higher education within an epistemic engagement pedagogical approach.

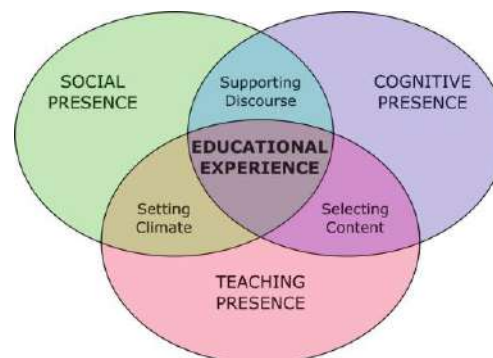


Figure 1 Community of Inquiry Framework. From "Critical Inquiry in a Text-Based Environment: Computer Conferencing in Higher Education," by Garrison, Anderson, and Archer, 2000, *The Internet and Higher Education*, 2, p.88. Copyright 2000 by Elsevier Science Inc.

The Community of Inquiry framework is a social constructivist model of a learning process in e-environments, designed to assist educators in facilitating and guiding online learning. It was first introduced in 2000 by Garrison, Anderson, and Archer to denote a learning group of individuals that occurs at the intersection of three core aspects: cognitive presence, teaching presence and social presence (Garrison et al., 2000: 88). All three dimensions are interdependent (figure 1), and all three are vital for learning to occur (Rourke et al., 2001). In order to build deep and meaningful learning experiences, teachers need to establish all three presences in their learning

communities by applying different strategies and instructional activities (Fiock, 2020; Juárez-Díaz, & Perales, 2021). A Community of Inquiry is established through collaborative activities, group interactions, social integration, and increased engagement.

As suggested by Kreijns et al. (2004), Computer-mediated Communication systems impose obstacles that can affect social interaction from both socio-emotional and cognitive perspectives in terms of the dynamics of a group or Community of Inquiry.

2.2 Social Presence

The concept of Social Presence has been defined and approached differently over the last decades, which only confirms the complexity of the phenomenon. As Tu suggests, the Social Presence is “the degree of person-to-person awareness, which occurs in the computer environment” (Tu, 2002: 34), or it can be defined as “the ability of people to present themselves as ‘real people’ through a communication medium” (Lowenthal, 2009). Another standpoint is that Social Presence means co-presence, or the experience of being together in telepresence (Collins, & Murphy, 1997). More broadly defined, Social Presence is perceived as a self-projection into a virtual group (Rourke et al., 2001), or as “a supportive collegial online setting” (Shea, & Bidjerano, 2010: 1722). Finally, social presence is reported to exist ‘in degrees’ as a person is not merely present/absent, but always engaged to a certain extent (more or less) (Kehrwald, 2010).

Research suggests that students create Social Presence “by projecting their identities and building online communities through CMC, despite its lack of non-verbal and social context cues” (Tu, 2002: 38). In other words, students are supposed to be “who they are” in online classes, to willingly expose their personalities and accept others’ in a trusted e-environment. Full personal, social, and academic integration is necessary to obtain successful learning outcomes (Juárez-Díaz, & Perales, 2021). Social presence is thus the ability of a learner to identify with the learning community and project themselves in order to develop interpersonal relationships, or “the degree of salience of the other person in a mediated communication and the consequent salience of their personal interactions” (Short et al., 1976: 65). The lack of social presence results in poor peer-peer and peer-instructor interaction, which might lead to anxiety, dissatisfaction, and ineffective learning (Tu, 2002). For bridging the gap between the lack of social cues in CMC and the need to share feelings and emotions with their peers, learners use emoticons (emojis) to personalize their messages (Pritchett et al., 2014).

Wut and Xu (2021) examined the relationship between Social Presence and online learning in general, taking into consideration both students’ and instructors’ perspectives. They found out that in ERT, even though teachers are aware that students are present in classes, they cannot assess whether the actual learning is taking place. Their findings suggest that Social Presence needs to be enhanced as CMC cannot fully establish cognitive/affective Social Presence without additional effort or guided strategies such as encouragement, consultations, peer evaluation etc.

Teachers’ role in establishing a successful Community of Inquiry in which the Social Presence level is high is a key component in establishing a successful learning experience (Avsheniuk et al., 2020). Assalahi (2020) investigated students’

perceptions of the ERELТ course from the perspective of the causal relationship among teaching, social and cognitive presences, and found out that teaching presence was the core factor in sustaining an online community. Social Presence, as well as the other two mentioned presences, can be cultivated and enhanced in e-environments by numerous interventions and adjustments of instruction and adaptation of courses (Fiock, 2020; Juárez-Díaz, & Perales, 2021; Avsheniuk et al., 2020).

3. Method

The study adopted an exploratory research design under the Social Presence theoretical framework, and the data were collected through an online questionnaire. The sample consisted of 91 second-year and third-year students of engineering (Electric power engineering, Computer and software engineering, Engineering management) at the Faculty of Technical Sciences Čačak, University of Kragujevac in Serbia, who attended a 15-week course in Business English during the fall semester in 2021. The course, initially designed to be delivered F2F, fully shifted to the online environment using the Microsoft Teams platform. During the course, lecturers utilized all the available tool features (online video calls, online teaching hours, public chat, private messages, assignments, online assessments, grading, attendance report etc.) that enabled a wide range of instructor and student interactions during the course. At the Faculty of Technical Sciences Čačak, the Teams platform has been in use since May 2020, so the students were already familiar with its features when the online Business English course started. The lectures were conducted as virtual face-to-face meetings, but the recordings of online classes were also available for re-visiting along with other learning materials. At the end of the course, the questionnaire was distributed through Office 365 Forms, by sharing a form link.

The survey instrument was adapted from the Collaborative Learning, Social Presence and Satisfaction questionnaire developed by So and Brush (2008) and further adapted by Pritchett et al. (2014). The wording of the questionnaire was slightly changed and translated into Serbian. Section one of the questionnaire was related to demographic questions (age, gender and perceived level of computer skills). Section two of the questionnaire consists of 21 statements related to Social Presence, while section three of the questionnaire has 13 statements related to MS Teams' satisfaction. All statements asked for a response on a 5-point Likert scale that included strongly disagree (1), disagree (2), neutral (3), agree (4), and strongly agree (5). The validity of the instrument was confirmed by relevant research studies that deployed similar instruments (Pritchett et al., 2014; Driver, 2002; Tu, 2002). The statistical program used for obtaining the results was SPSS.

The following range of Means with its descriptions was used: 1.00 – 1.44 = strongly disagree, 1.45 – 2.44 = disagree, 2.45 – 3.44 = neutral, 3.45 – 4.44 = agree, and 4.45 – 5.00 = strongly agree. The reliability of the scale for the instrument was determined by the Cronbach Alpha's Coefficient, with a result of 0.928, which indicates significant consistency. For all the questions, the SPSS software processed the data and descriptive statistics were used to generate the results. Finally, to calculate the correlation between Social Presence and satisfaction, we grouped the items of the questionnaire into two categories and utilized Pearson's product-moment correlation coefficient to analyse the relationship.

3.1 Participants

As for demography, 47.3% of the respondents identified as male, 51.6% as female, whereas 1.1% declared as 'other'. As many as 47.3% of them belong to the '17-20' age group, while 44% of the respondents belong to the '20-25-year-old' age group. Only 8.8% of the sample belong to the 'over 25' age group. As many as 63.7% of the respondents believe that their digital literacy (computer competence) is of an intermediate level, whereas 27.5% of the sample think that their skills fall within the 'advanced' category. Only 8.8% of the respondents believe that their computer skills are of a beginner level.

4. Results and Discussion

The respondents agreed that CMC messages are social forms of communication ($M=3.78$) and that they allow users to establish relationships based upon information exchange ($M=3.91$). They also reported that communication via CMC is comfortable if they are communicating with a familiar person ($M=4.38$) or when the topic is familiar to them ($M=4.12$). The respondents also agreed that expressing their thoughts is easy through CMC ($M=3.48$) and that the number or length of messages does not inhibit their ability to communicate ($M=3.76$). They also stated that the point of access to CMC does not affect their ability to communicate ($M=3.49$). As Table 1 shows, the respondents were neutral towards the following statements: how pleasant CMC for communication was; the CMC's ability to build caring relationships with others; how meaningful or easily understood CMC appeared to be; how (un)comfortable they felt participating if the topic was or was not familiar to them. The respondents were also neutral about CMC's reliability, and about whether CMC messages had impersonal character, as well as the possibility that someone could obtain their private information. Finally, the last three statements of the second section were also evaluated as neutral: how uncomfortable they felt when talking to an unfamiliar person; how unlikely is that someone might misuse their messages; and how confidential CMC was. On the other hand, the respondents disagreed that CMC could convey feelings ($M=2.38$) and build trust in others ($M=2.39$).

These findings on the Social Presence suggest that in CMC students feel motivated to communicate with the person they have previously met in person, on a topic they are familiar with, and that the bigger number (or length) of CMC messages is not perceived as overwhelming to be handled. However, their suspicion of CMC's capacity to express their feelings, or trust in people who are 'on the other side' implies that they already experienced impediments or difficulties in CMC communication in that context.

Table 1 Social Presence

Statements – Part 1	Mean	St. Deviation
(1) Computer-mediated communication messages are social forms of communication.	3.7802	1.10355
(2) Computer-mediated communication allows relationships to be established based upon sharing and exchanging information.	3.9121	1.01815
(3) I am comfortable communicating with a person who is familiar to me.	4.3846	0.90393

(4) I am comfortable participating in computer-mediated communication if I am familiar with the topic discussed.	4.1209	0.94086
(5) Using computer-mediated communication is a pleasant way to communicate with others.	3.3077	1.12242
(6) Computer-mediated communication conveys feelings and emotions.	2.3846	1.19042
(7) Computer-mediated communication allows me to build more caring social relationships with others.	2.6374	1.19737
(8) Computer-mediated communication permits the building of trust relationships.	2.3956	1.09422
(9) The language people use to express themselves in computer-mediated communication is meaningful.	3.3516	1.11926
(10) The language used by others to express themselves in computer-mediated communication is easily understood.	3.4396	1.06676
(11) It is easy to express what I want to communicate through computer-mediated communication.	3.4835	1.09912
(12) The large amounts of computer-mediated communication messages, including numbers of messages and lengths of messages, do not inhibit my ability to communicate.	3.7692	1.05490
(13) I am comfortable participating, even though I am not familiar with the topic.	3.0220	1.20165
(14) Where I access computer-mediated communication (home, office, computer labs, public areas, etc.) does not affect my ability or desire to participate.	3.4945	1.21448
(15) I am uncomfortable participating in computer-mediated communication if I am not familiar with the topic being discussed.	3.3187	1.28131
(16) Computer-mediated communication is technically reliable or free of system or software errors that might compromise the reliability of online messages reaching only the target destinations.	3.0769	1.18538
(17) Computer-mediated communication messages are impersonal.	2.8352	1.14759
(18) It is unlikely that someone might obtain personal information about me from computer-mediated communication messages.	2.7253	1.25668
(19) I am uncomfortable communicating with a person who is not familiar with me.	3.0220	1.27347
(20) It is unlikely that someone else might re-send my messages.	2.7253	1.26549
(21) Computer-mediated communication is private/confidential.	2.6044	1.25503

The third section of the questionnaire deals with the students' satisfaction with MS Teams and the responses of the respondents are distributed within three ranges only: strongly agree, agree or neutral. The highest score (strongly agree) was given to the third statement (M= 4.61) which reads: "Overall, I am satisfied with the teacher's guidance during the discussion". The students agreed that they were able to learn through MS Teams and that communication was a useful experience. They also

agreed that they are satisfied with what they learned in the English language classes held on MS Teams, as well as with the discussions, diversity of topics and overall communication. The students were neutral towards the English course held via Teams as a means of making new friends, or the English course as an encouragement to participate in similar discussions in future. They were also neutral about discussions helping them to understand different points of view, or about being engaged in additional research or self-study. Finally, they were neutral about their computing skills necessary to utilize MS Teams for the English course purposes.

These findings suggest that students' overall satisfaction with MS Teams in the ESP course was mainly due to the teacher's successful guidance, whereas they were not sure whether they made new friends or were encouraged to do some additional work. By and large, the respondents expressed satisfaction with both the communicative (CMC) and technical (Teams) part of the ESP course, and they perceived that they could benefit from the Col in terms of achieving learning outcomes.

Table 2 MS Teams Satisfaction

Statements – Part 2	Mean	St. Deviation
(1) As a result of my participation in the English course using MS Teams, I made acquaintances electronically in other parts of the country and/or the world.	2.8901	1.28626
(2) As a result of my experience with MS Teams in the English course, I would like to participate in another discussion in the future.	3.0769	1.50725
(3) Overall, I am satisfied with the teacher's guidance during the discussion.	4.6154	0.69553
(4) The discussion assisted me in understanding other points of view.	3.4176	1.28293
(5) I was able to learn through the medium of computer-mediated communication.	3.5934	1.25590
(6) The communication was a useful learning experience.	3.8681	1.16627
(7) I was stimulated to do additional readings or research about the topic discussed during MS Teams sessions.	3.1209	1.24575
(8) Overall, I am satisfied with what I learned in the English language course through MS Teams.	4.1758	1.06033
(9) Overall, I am satisfied with the communication during the MS Teams English classes.	4.2418	1.00378
(10) I was able to learn from the MS Teams class discussions.	3.6813	1.20073
(11) The diversity of topics in this discussion prompted me to participate in the discussion.	3.4615	1.22300
(12) My level of learning that took place in the discussion was of the highest quality.	3.3736	1.28796
(13) I put in a great deal of effort to learn computer-mediated communication skills (e.g., how to use MS Teams) to participate in the classes.	3.0989	1.20236

In terms of the relationship between the two main categories we investigated, the findings of the study indicate that there is a moderate positive significant correlation between Social Presence and Satisfaction ($r=.63^{**}$, $p=.000$). By the results obtained

using Pearson's correlation, the higher the students' value the Social Presence (M=3.19) the higher their Satisfaction (M=3.57) with the Teams in the ESP course appears to be. This conclusion supports previous findings that Social Presence affects the degree of satisfaction in CMC environments (Pritchett et al., 2014; Lowenthal, 2009; Gunawardena, & Zittle, 1997).

5. Conclusion

Due to the COVID-19 pandemic outbreak, universities across the globe shifted to Emergency Remote Teaching to secure educational continuity. Emergency Remote English Language Teaching in the context of ESP courses was conducted through various platforms and tools, one of them being MS Teams. Current studies indicate that the lack of person-to-person interactions in CMC affects the quality of instruction, so it is of great importance that educators establish Communities of Inquiry in which Social Presence is specially cultivated. This research study showcased that Social Presence appears to be a relevant phenomenon that adds to the overall quality of online teaching and learning and is a strong predictor of satisfaction in the CMC environment (MS Teams). The findings showed that students expressed satisfaction with both the communicative (CMC) and technical (MS Teams) part of the ESP course, highly valuing teachers' guidance and their communication skills in the Col. Further analysis confirmed that there is a moderate positive correlation between Social Presence and Satisfaction. These results are in line with previous findings that Social Presence affects the degree of satisfaction in CMC environments (Avsheniuk et al., 2020, Pritchett et al., 2014; Lowenthal, 2009; So, & Brush, 2008; Gunawardena, & Zittle, 1997).

One of the limitations of the study is that it did not include the previous testing of the respondents' computer skills that could significantly impact their use of Teams, but, instead, it relied on the students' self-assessment. It is also not without acknowledgement that the sample comprised only engineering students, whose computer skills might be on a higher level than those of the students of other profiles. Bearing in mind that the Col framework refers not only to Social Presence but also to teaching and cognitive presence, future research in this context should properly address all three dimensions.

Finally, this research has highlighted several important practical implications. Firstly, the study advocates integrating MS Teams as a convenient and efficient tool in ESP courses, as it is perceived as a successful tool in establishing Col, and fostering the cultivation of Social Presence during ERT. Secondly, the findings suggest that students' overall satisfaction with MS Teams in the ESP course was mainly due to the teacher's communication skills in the ESP course. As "[n]o CMC is itself capable of creating a social space" (So, & Brush, 2008), educators should use instructional strategies that support components of Social Presence, establishing Cols that enhance group cohesiveness and trust, connectedness, sense of belonging, and a strong sense of community. In that way, the digital gap that causes students' learning disruptiveness in ERT would be more easily bridged.

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A LOW-COST INTERNET OF THINGS ARCHITECTURE PROPOSAL FOR URBAN AND SCHOOL GARDENS

Sara Blanc, Senén Palanca

Universitat Politècnica de València, Valencia, Spain
sablacla@upv.es

Abstract. This paper presents a low-cost solution to connect environmental protection learning and Internet of Things technology. The proposal is an example of the transfer of knowledge between university and schools. It is aimed at secondary school teachers and students to let them develop new experiences connecting informatics, technology, as well as other curricular subjects, with school gardens. Such an experience is both, complete enough to develop multiple digital competences and computational thinking skills and, sustainable over time since the project can grow every year with new environmental proposals and new technology challenges. The paper describes the learning process, the followed architecture and, the impact of “simplicity” decisions on in-app display lag. The results show that the proposal is viable.

Key words: *Internet of Things; Urban School Gardens; Education; app development; Smart Agriculture.*

1. Introduction

Information and Communication Technologies (ICT) include paradigms and advanced technologies such as the Internet of Things, Big Data, and Cloud Computing. These technologies are transversal to every economical sector. For example, Internet of Things (IoT), in conjunction with other technologies such as Sensors Network, Cyber-Physical Systems, and Edge/Fog/Cloud Computing, are novel solutions and architectures in development in Smart Agriculture. Some of the most prominent challenges are the placements of agro-sensor or agro-robot, the processes of production and harvesting, or the lack of awareness among farmers.

Precision agriculture is an agricultural-management approach that uses Information Technology (IT) to ensure that crops and soil receive exactly what they need for optimal health and productivity. The main goal is to guarantee profitability, sustainability, and environmental protection but also social equity [1] and corporate social responsibility [2]. The large economical differences between regions [3] make the application of technology to farming an overall social problem being essential to expand the awareness about the need, benefits and right among every actor from policy makers to society in general.

The term Smart in Agriculture has been referred as Smart Farming Precision Agriculture or Precision Farming, Decision Agriculture, Digital Agriculture, Agriculture 4.0 or what is referred to in French as Agriculture Numérique [4]. Its interest spreads off the area of technology to humanities and economic research.

Agriculture jumped to the cities in the last decade been referred as Urban Agriculture or Urban Gardens. Experts and stakeholder view is reflected in the 2030 Agenda for Sustainable Development, the Goal 11, Sustainable Cities and Communities, is

specifically dedicated to urban systems and its ambitious goal is “Make cities and human settlements inclusive, safe, resilient and sustainable”. It takes a relevant insight in regeneration of abandoned or degraded urban gardens, with a prevalent social and inclusive function [5].

Serving the same benefits, urban gardens have been established in many cities and communities over the last decade. The social benefits are of different nature, such as an alternative for fresh production, environmental protection, or social inclusion [6].

As well as farming, the use of technology seems a real necessity in urban gardens. For example, to detect contaminants in the soil as effect of urban contamination [7] and it also aligns with concepts such as water efficient consumption, which is both a necessity in agriculture and an educational challenge for society.

At educative level, urban gardens mean a practical learning about biodiversity and sustainability [8]. Connecting the world reality and its problems with education is also a challenge. Schools are every day increasingly aware of integrating real problems as learning case studies. Some studies describe the effects on participants of experiences based on school gardens [9] or introduces students in school gardening through digital media [10]. Although there is not a significant conclusion about the effects on participants, the number of practices around the world reveals the trending on the connection between digital medias and outdoor gardening.

Among digital media and digital tools, urban and school gardens can connect edge-cutting technologies learning with biodiversity and sustainability practices. For example, Internet of Things is currently present in most of the smart deployments both in agricultural extensions with multihop routing [11] or multi-sensors integration [12] on small plantations.

Different works demonstrate the possibility of implementing this technology at different levels, considering the plantation size. We find examples of high-cost professional development, but also low-cost educational examples.

For example, the paper of Codeluppi et al. (2019) [14] proposes a simple architecture which can be implemented with educational kits. In Lopéz Iturri et al. (2018) [15] authors introduce both an architecture and the educational app *MySchoolGardenApp*. The advantage of developing an app is to increase the participants in the experience. In addition to technology for the development of architecture, it is possible to involve other subjects such as mathematics, for data analysis and exploration, or natural sciences to learn about sustainable consumption, for example, in water consumption.

This paper presents a low-cost solution to connect environmental protection learning and Internet of Things technology.

The difference between [15] and others is to promote an open architecture which allows a progressive extension according to garden needs and learning goals. Moreover, the work presents an educational app. Thus, the learning scope ranges from the use of the app for any student at the school, to the development of real monitoring systems combining coding and electronics with others such as 3D printing or web solutions.

2. The proposal

Weather stations and other agriculture instruments created with sensors are directly related to your school garden since the data collected by these instruments shows how different weather and soil variables influence crop irrigation and crop health.

Activities focused on developing instruments and software applications improve many soft competences in students, such as mutual respect, collaboration, active listening, teamwork and project solving, among others.

Firstly, these activities include the use of digital tools and platforms, programming, understanding of the interoperability of machine-devices, database learning and data analysis and exploitation. Thus, the learning experience strengthens many skills and competences in the European DigCom framework:

- Information search and retrieval.
- Communication and collaboration in digital environments.
- Safety in digital environments.
- Creation of digital content.
- Problem solving.

Secondly, environmental competences are also strongly connected with these activities. By learning in technology, the real final goal is directed at the efficient use of natural resources and the responsible use of water. For example, various cognitive items can be assessed in students, such as the following:

- The student understands how much water is needed to irrigate a small garden.
- The student understands which elements influence the contamination of the environment.
- The student understands how pollution affects the garden.
- The student understands how the garden is dependent on weather conditions.

Socio-emotional and behavioural objectives are also developed around responsibility and active transformation in individual actions.

Thus, the urban school garden can be transformed into a learning space to implement multiple activities, among which technology is highly recommended. We transform the real garden into a virtual garden under the following learning principles:

- Active participation in the development of artefacts to monitor the garden.
- Initiation to high threshold level concepts such as interoperability, database storage, syntaxis and semantics in communication or data interchange.
- Data exploitation.
- Observation of artifacts outputs within an educative interface to connect cognitive knowledge learned in mathematics, physics or science with informatics and technology.

To reach these three principles we define three components to be developed in the learning process:

- Sensing modules using educational kits for coding.
- An Internet of Things architecture as an edge-cutting umbrella under which many “informatic” concepts can be depicted.

2.1 Sensing modules

A garden is not just a mishmash of vegetables. A garden has several components that play a part in the daily gardening processes. A school garden has different spaces, which must be planned. To organise our garden, we take different spaces into account such as a nursery area for seedbeds, a compost area, a weather station, or the cultivation plots. Each of these spaces will also be organised in the same way in a virtual garden.

Internet of Things connects things around the world. The “things” are smart devices such as phones, tablets or watches, or small sensors hidden in our cities, houses, green spaces, or... in our urban school garden.

Small sensors have advantages and disadvantages. On the one hand, sensor devices are lightweight and handy, so they can be easily embedded in our environment. Moreover, we can build low-cost devices, and by building these devices with our students we also promote many STEAM competences to work with. On the other hand, as a disadvantage, sensor devices are “low intelligence”, meaning they are unable to store much data and can only carry out processes that are not very complex.

The solution is to connect the “things” with the internet network. Data collected by the sensors is uploaded to the network and stored in a cloud.

Sensors are useful to observe our garden and make important decisions. Considering the school garden structures, we could add sensors such as:

In the seed nursery: One of the most important aspects when establishing a school garden is to choose crops properly. Ambient temperature and humidity requirements differ between the seedbed phase and growing phase. Therefore, we should look for a suitable seedbed space or nursery to maintain optimal germination conditions by controlling ambient temperature, ambient humidity, and brightness.

In the weather station: A weather station is an ideal activity to introduce students to the world of sensors. We will find very different types, with different measurements and magnitudes, such as ambient outdoor temperature, ambient humidity, air quality (e.g., CO₂ or NO), rainfall, noise, brightness, etc. We can take advantage of this variety to connect the garden with subjects such as mathematics and science.

In the compost machine: You can use manual thermometers or make a module, similar to that of a weather station, with temperature and humidity sensors. Build a box and use dust filters to prevent damage to the sensors. Sensors should be embedded in the compost mix, taking temperature parameters as deep down as possible.

In the plots: There are specific sensors for soil temperature and humidity and professional probes to measure in different soil profiles. A profile refers to a vertical depth that measures a value every 10 cm deep. We can differentiate between top-soil humidity, indicating a depth of about 20 cm, and bottom-soil humidity, indicating a depth of 50-90 cm or more.

Additionally, some actions could be added to the garden, such as making an electro-valve open or close.

2.2 The IoT Architecture

A step forward for schools is to train their students as solution developers which means an advanced autonomy level.

An IoT gardening system can be seen as a learning value chain structured in three knowledge domains, from sensors to human intervention:

The Things Knowledge. It brings students closer to the physical layer or hardware. It is the contact with devices which connect physical world with Internet. Applied to gardening, things are sensors and students will learn about programming languages, devices and Data understanding. The Things Knowledge relates with advanced and highly specialized digital tasks.

The Information Knowledge. It represents the connection with the digital world. Machine to machine communication, cloud data storage and retrieval, information management or processing are main aspects related with Information Knowledge. The complexity level varies from intermediate by adopting commercial “connect-and-play” platforms, to high specialized by developing ad-hoc solutions.

The User Knowledge. Probably it is the most relevant from the point of view of sustainability. User Knowledge works in the cognitive domain looking for solutions to real problems. For example, directing the focus of attention on the SGD learning objectives. Machine-Human interaction is a powerful duple when human is able to decide about the objective for such interaction. In other words, User Knowledge makes the technology really useful. In such a way, digital expertise increases from the use of apps, websites, the Internet search engines, etc. till a proficiency level with the development of apps or new digital contents.

Moreover, working on IoT projects has additional advantages. For example, it allows developing different applications with similar IoT structures. Thus, there are a significant quantity of different projects that could be proposed just by changing both the sensors and the applicability idea. Moreover, when the structure is not changed, projects can be aimed to build progressively a bigger system, adding new sensors or new functionalities to the application.

Despite the advantages of adopting IoT as case study to learn and progress in the EU digital competences framework, we must deal with important drawbacks. On the one hand, teachers should be competent to face the challenge of leading classroom technology supported projects. On the other hand, technology moves fast, and changes use to arrive first to high levels of education than to schools.

The alliance of educational actors in Europe would benefit a fast and motivated knowledge transference in the digital field. High education and schools from Europe could collaborate together with public and private organizations with social concerns and environmental responsible.

The objective of such an alliance is to share experiences, good practices and work on adapting school’s curricula to be more environmentally aware. Moreover, the alliance fosters teachers training in the three domains of knowledge.

In such a way we propose a simple and low-cost solution to secondary schools. A single microcontroller can handle multiple sensors. We propose one microcontroller, such as ARDUINO, per space, with system on chip or system on board solutions that include a communication transceiver.

Microcontrollers are deployed in a local network topology. Among the possible communication options, some technologies will allow to upload sensor measurements directly to the internet network. For example, mobile, LTE-M, NB-IoT, satellite, etc.

Alternatively, it is possible to install a gateway to reach the IoT cloud, or it is possible to build a bridge.

Many educational and inexpensive boards do not include communications transceivers. Additionally, because distances in a garden can range from few meters to several kilometres from the school infrastructure, we propose LoRa RF communication protocol (<https://lora-alliance.org/>). LoRa RF connects the devices by using ‘shields or hats’ that, arranged in sandwich style, transform the boards into a wireless node.

For example, Figure 1 shows a bridge between two technologies: Wi-Fi and LoRa RF:

- A node reads data from its sensors and sends this information to the homemade bridge. LoRa RF is the communications technology chosen, due to its long range in outdoor environments.
- Your bridge receives “data packages” and re-send this information via your school Internet connection to the IoT cloud.

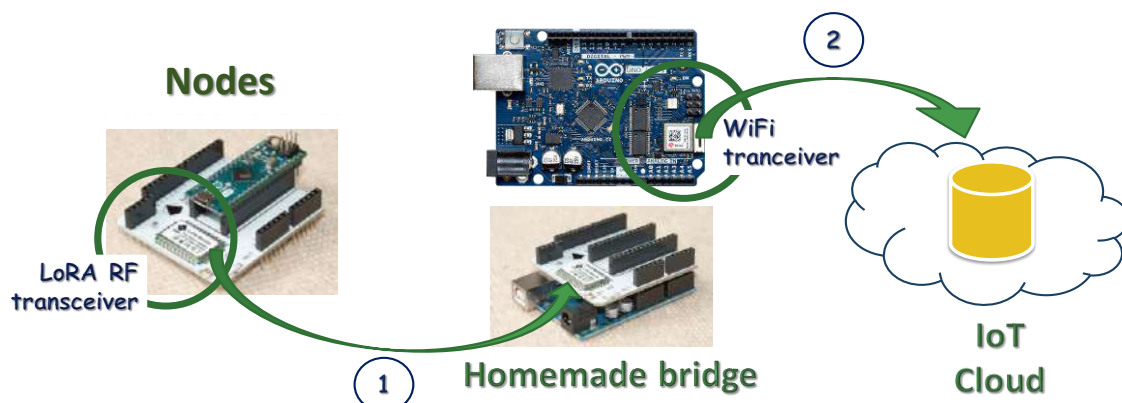


Figure 1 A bridge between Wi-Fi and LoRa RF with Arduino boards

There are multiple potential topologies to deploy the IoT school network. Figure 2 depicts the simplest one: the start topology.

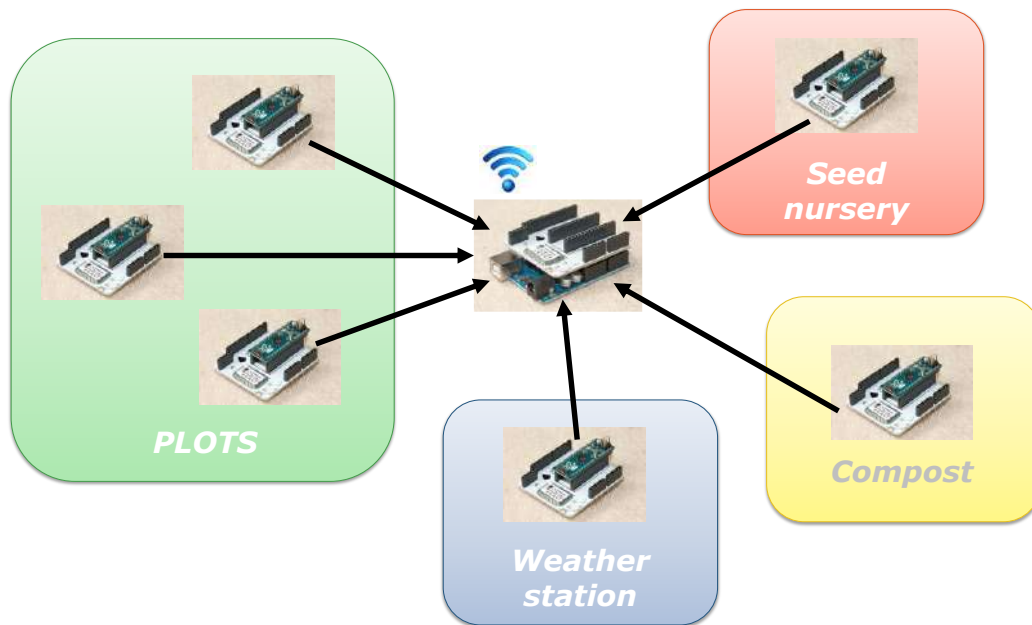


Figure 2 The start topology in the IoT school network

The sink node in Figure 2 is also a Gateway between the local network and the Internet network. Thus, the Gateway is, on the one hand, a bridge between communication technologies and, on the other hand the connection between the garden and the cloud. Data strings are sent, or received, by the nodes in the local network during a short period of time. At the end of the cycle, the Gateway composes a unique JSON packet to be uploaded in the cloud. Figure 3 shows an example of a packet composed by measures from two nodes.

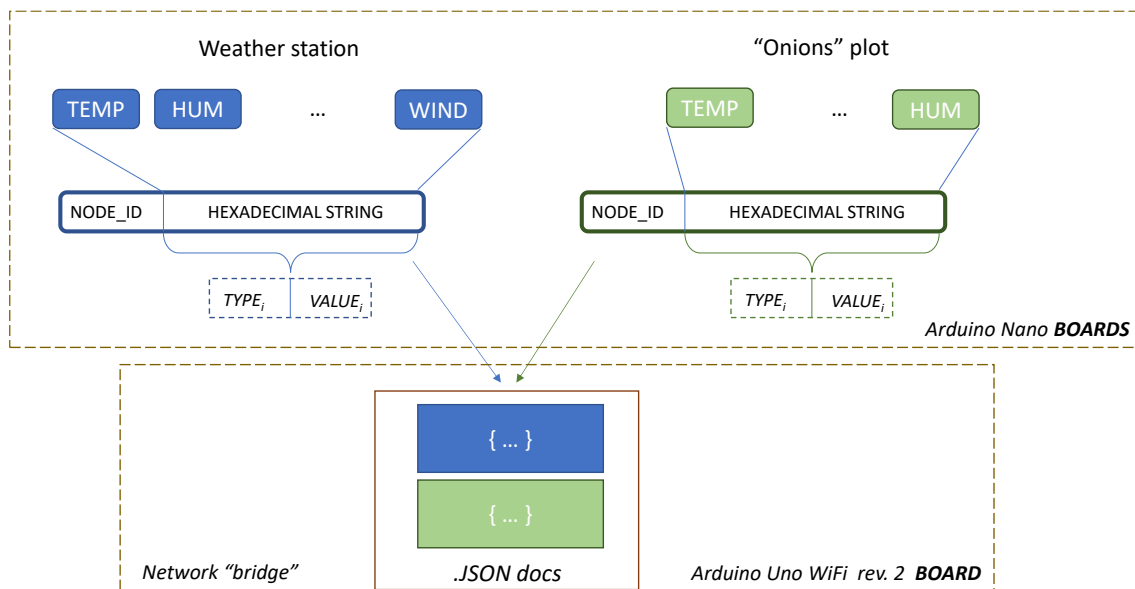


Figure 3 Packet construction adding single sensing messages

Periodically, the Gateway sends a block of data to the database. Each block includes measurements from several sensors, whether they are simple or multiparametric. It is

not necessary a message per each new sensed measurement. Several measurements are sent in the same message. But it does build a separate message per node.

The cloud stores data received from the Gateway in a compatible structure with the app developed. An example of third-party cloud is Firebase by Google. The structure designed in the real time database is as follows.

A hierarchy top level which contains the collections “alerts”, “gardens” and “vegetables”:

Alerts: Sensor values outside the thresholds assigned in the app sensor settings. These alerts are based on checking the value of each new reading received from a sensor and comparing it against the thresholds. They are defined in the app.

Gardens: To give flexibility to our activities, we have considered the possibility of creating more than one garden for the same school. Each garden is an object which contains metadata such as city, latitude, longitude, etc. and the sensor data divided into data from the weather station, the seedbed nursery, the compost space and one or till 8 different plots. Among the information required in each space (Figure 4), “items” lists the sensors and actuators attached to the space, while “valve” represents the state of the actuator and the operation range. Finally, “data” registers the type of measure, the value and timestamp.

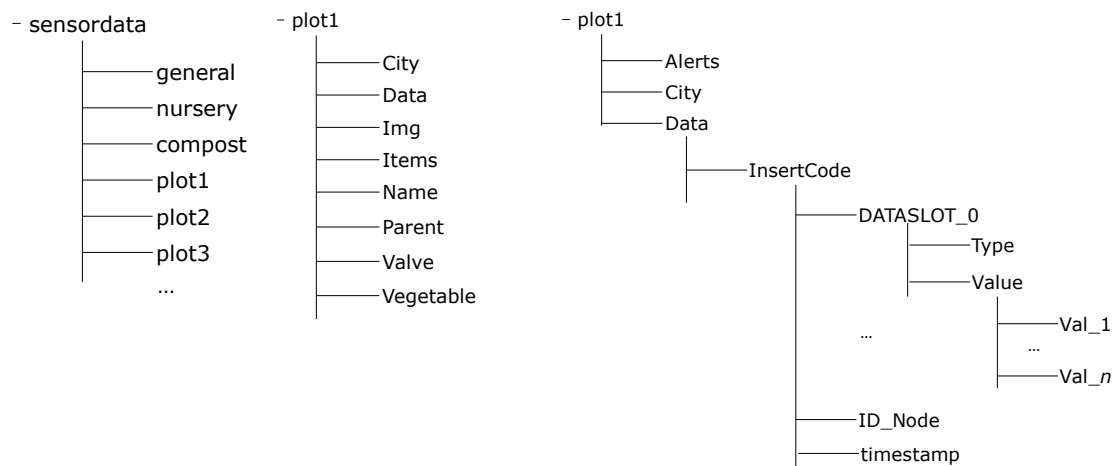


Figure 4 Firebase real-time database structure

Each one of the received blocks (or Gateway messages) hangs from the "Data" field. They are not reordered. They are registered in chronological order of reception with their timestamp: “InsertCode”.

Each “InserCode” has one or more DATASLOTS. Each DATASLOT contains the data of a single or multiparameter sensor. The type of the sensor and its value are registered inside the DATASLOT structure.

Therefore, it has been chosen simplicity in the structure of the database, although this simplicity causes delays in the app refresh time, as we will analyse in the following sections.

The reason for this simplicity is to make the database understandable by students and teachers new to IoT.

The project assumes that both teachers and students will build their own database following the same structure. Furthermore, this structure can be configured automatically when launching the app for the first time and creating the first garden.

Everything is easy in understanding and exploiting the data, both at the database and app level.

Vegetable: This indicates the different crops that can be used in the application. We have introduced the most recommendable crops for a growing cycle coinciding with the school terms in Spain. In addition, they are also the most resistant crops and can, in general, give better results. The object includes educative information about the crop, images and optime temperatures. This information is shown in the app.

2.3 The educational app

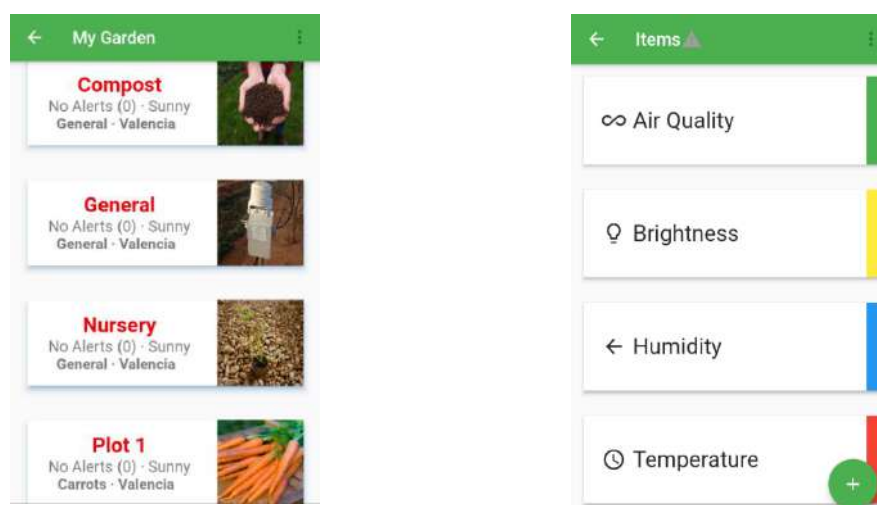
The app is designed for a young audience in an educational environment. The objective of the whole system is to facilitate the learning of technologies for new generations of students, in addition to bringing them closer to the use of agriculture. The app offers to the students a global vision of the distributed system.

As the app is designed for very young people, it is minimalist and simple. Bright colours have been used in sections with actions and, lists, icons and visual indicators have been chosen instead of textual information to facilitate better understanding.

The app follows the same logic model than the sensing space division as the physical garden and the database. Moreover, the app supports teachers' and students' roles. Teachers can create/remove gardens, create/remove spaces and define alerts using thresholds. Students can add or remove sensors from their view without affecting the database. Views include daily graphs and historical graphs. Figure 5 shows some app screens.

In Figure 6 we see the process of displaying the app. As in the structure of the database, a simple process has also been chosen.

The negative impact of this simplicity is observed in the loading and refreshing of data in the app installed on mobile devices. The app must go through the lists of InsertCodes and detect and classify it in a daily graph and for a sensor. We will analyse the impact in the results section.



Logic space division

Sensors and actuators in each space



Daily graphs



Zoom options

The screenshot shows the 'Onions' app screen. It features a header with a back arrow and the title 'Onions'. Below the header is a photograph of red onions. A text block describes the plant: 'The onion plant has a fan of hollow, bluish-green leaves and its bulb at the base of the plant begins to swell when a certain day-length is reached.' Below the text is a small icon and the text 'Onions from Asia' with a temperature range 't 12° C - 36° C'. At the bottom, there is a detailed text block about the plant's characteristics and growing conditions.

Information about the crop



Multiparametric sensors

Figure 5 App screen view

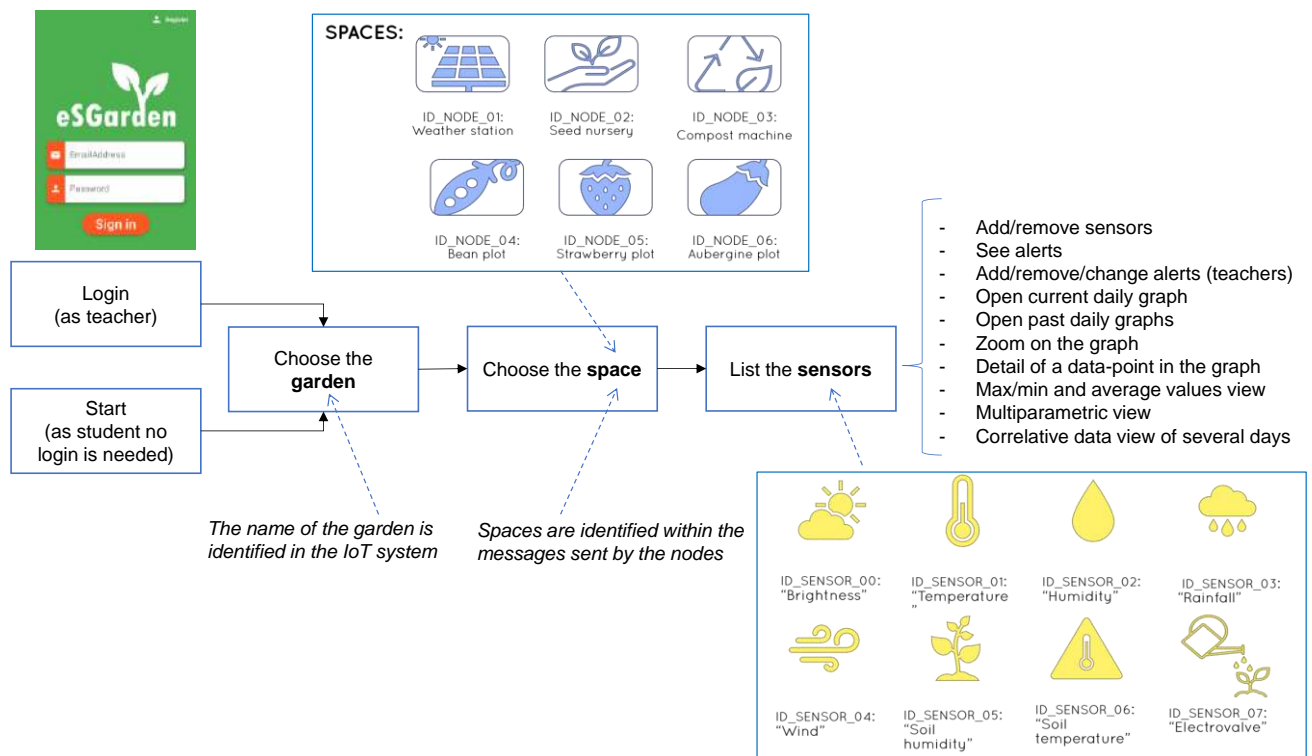


Figure 6 App human process

3. Results

As explained above, the need for a simple JSON-like structure in the database will impact the in-app display lag of new inserts. Once inserted for the first time, each DATASLOT is classified. Therefore, in our test we focus on the refresh time of new data. We test the app in stressful conditions. The results show the latency time from the occurrence of an update event of a new value in the database until this data is visualized in the daily graph. What will happen if a sensor sends data very frequently? How long will it take for the app to collect, clean, and display that data?

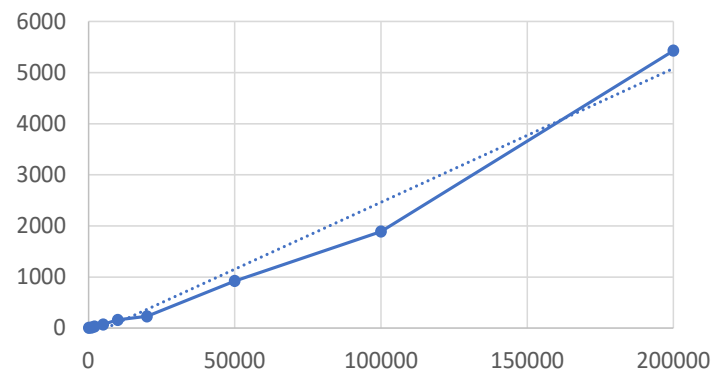
The test simulates data within the formula $y = \cos(x) + 15$.

Table 1 shows the app latency time to add the new measure in a daily graph and the number of values uploaded in the database in each simple event, it means, in the message the Gateway sends to the database in the JSON package.

We observe that, for a large amount of data, the latency time is quite high, being a restriction that should be taken into account when sizing the number of sensors and sending data per cycle of the school garden.

Table 1 Refresh time observed in the app

New uploaded values	Refresh latency time
100	7 ms
1000	10 ms
2000	32 ms
5000	73 ms
10000	161 ms
20000	230 ms
50000	922 ms
100000	1889 ms
200000	5430 ms



Although time increases, we see that the linear trend fits well with growth. This is because it is only necessary to classify new data, not data already represented. Therefore, we have achieved a valid balance between simplicity and delay time.

4. Conclusions

The work presents an overview of an educative IoT project where both students and new and expert teachers can develop their own experience working on all the development phases: from sensors to visualization. The proposal prioritizes simplicity in three items: the semantics of messages, the structure of the database and the visualization process with an app.

Despite the proposed simplicity, we see that the possible negative impact on the refresh time of the app data does not present an exponential growth but a linear one.

The proposal is aimed at secondary school teachers and students. It is an open and participatory proposal. In addition, it is also sustainable over time since the project can grow every year with new proposals for sensor nodes without changing the structure of the database or the app. Therefore, it will be possible to integrate learning in robotics and computer science with other subjects such as science, technology, art, mathematics, etc.

5. Acknowledge

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RELEVANT EXPERIENCES IN BACHELOR'S DEGREE IN INDUSTRIAL ELECTRONICS AND AUTOMATION ENGINEERING

Luis David Sánchez Diana

Florida Universitaria, Valencia, España
lsanchez@florida-uni.es

Juan Jose Cabezas

Florida Universitaria, Valencia, España
jicabezas@florida-uni.es

Antonio Ortega Valera

Florida Universitaria, Valencia, España
aortega@florida-uni.es

Eduardo José Roses Albert

Florida Universitaria, Valencia, España
eroses@florida-uni.es

Abstract. In recent years, competence-based learning has changed the teaching methodology and assessment models in universities. In this context, students have developed a large number of projects based on project-based learning methodology or challenge-based learning. This article aims to highlight some of the most relevant projects related to the degree in Industrial Electronics and Automation Engineering. In particular, four experiences recently carried out by students of the degree in Electronic and Automation Engineering at Florida Universitaria will be presented. The first work describes the development of a software for the calculation and design of DC boost converters. Based on certain design specifications, the software allows the design of the converter elements, as well as obtaining simulations of its final performance. The second project presented in the article consists of the design and assembly of a camera with integrated image processing for artificial vision applications in the field of industrial robotics. The system not only allows the identification of workpiece patterns, basic shapes and their orientation, but also enables the detection of colour and the estimation of the measurements of the processed workpieces. The next challenge presented is a teamwork and is related to the Development and Sustainability Goals (ODS). More specifically, it involves the monitoring and automation of public green areas in a small city, with the aim of reducing water consumption, staff travel expenses and the associated energy costs. The last work consists of the development of a functional prototype of a solar tracker capable of obtaining and delivering energy in the most efficient manner.

Key words: *competence-based learning, teamwork, development and sustainability goals, challenge-based learning*

1. Introduction

Nowadays, the relationship between University and Society could be located in a dynamic confluence space, where permanent social changes affect the demands that define Higher Education training. On the other hand, the adaptation of university degrees to the European Higher Education Area (EHEA) has promoted, for more than

a decade, the appearance and modification of a large number of methodologies and procedures in university teaching. Because of these two factors and with the aim of undertaking strategies to return to sustained industrial productivity, some improvements are gradually being introduced in the training actions of the Schools of Engineering. Such improvements must respond to the growing need in terms of interdisciplinarity, teamwork and training in soft skills by the industry. In this context, Project-Based Learning (PBL) [1] has proven to be a teaching methodology highly effective, consisting of solving a problem or carrying out a project, normally of a certain size and tackled as a team. This active learning model, together with Problem-Based Learning, are the basis of Challenge-Based Learning (ABR), which «actively involves the student in a real, significant problem situation related to the close environment, which implies defining a challenge and implementing a solution for it» (de la Mano, 2018).

In short, the ABR, like the rest of the active methodologies, pursues the leitmotiv «Tell me and I forget, teach me and I remember, involve me and I learn» (Benjamin Franklin). This paper describes four relevant experiences challenges and projects related to the degree in Industrial Electronics and Automation Engineering.

2. Artificial vision system applied to industrial robotics.

Industry 4.0, or the fourth industrial revolution as some say, has come hand in hand with a series of new technologies that have changed the way products are manufactured, greatly increasing productivity. Some of these technologies are the Internet of Things (IoT), cloud computing, artificial intelligence and machine learning. Within machine learning is the so-called Computer Vision (CV), which consists of the capture and processing of images autonomously by a system for their interpretation. When this technique is applied to the industrial context, it is called Machine Vision (MV) [2].

The use of MV systems has changed the way robotic systems work, adding flexibility without the need to rely on many sensors to control and monitor processes. Due to this, these MV systems are currently used in inspection tasks, quality control, painting, welding, cutting and pick and place tasks among others [3], through pattern recognition on images or codes that the robot can see through a camera. This allows the rapid detection of defective parts, increasing the quality of the product, and eliminates the dependence on mechanical systems for the arranging of objects, since the MV system can detect their position and orientation. Now, the processing of the images collected by the camera is a heavy computational process, so it is necessary to have a system dedicated to this task.

The project presented here, "Artificial vision system applied to industrial robotics", proposes to use a camera connected to a Raspberry Pi using the Raspbian operating system and the OPENCV library, which is dedicated to artificial vision, to perform the image capture and processing tasks. The system is meant to be attached to a KUKA robot. The objectives regarding the construction of a prototype are the design of a 3D printed case for the camera, the Raspberry Pi and its power supply system, the design of a bidirectional communication channel that allows the MV system to communicate with an external system, the definition of a standard of connectors and input and output protocol, and the design of a program for the recognition of objects and codes. The

objectives regarding the functionality of the system are the identification and spatial location of marks or identifiers, detection of the orientation of objects and detection of basic shapes, colours and estimation of measurements. The assembly of the prototype can be seen in figure 1.

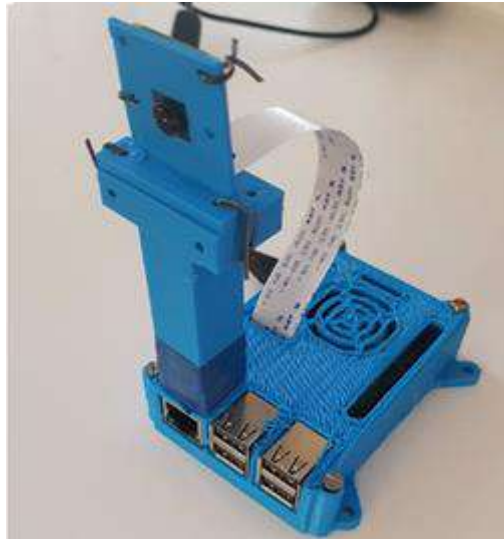


Figure 1 Prototype.

Firstly, the camera takes a picture for analysis. The image obtained is in RGB format, which is not supported by most image processing functions. For this reason, the image is converted to an HSV (Hue, Saturation and Value) format where, using matrices, the colour, saturation and brightness are classified. On the other hand, the conditioning of the image also requires filtering to eliminate noise. This noise is generated by various sources, such as vibrations in the machinery, particles in the air or the fact of using a camera with a low resolution, 640x480 pixels in this case. Two linear filters are used in this project: a mean filter, responsible for eliminating salt-and-pepper noise, and a Gaussian filter, which generates blurry images in exchange for consuming fewer resources.

To give the system flexibility, several functions have been programmed to cover different needs. These functions are: code detection, object detection through colour filtering, and object definition through background subtraction.

Adding codes to objects to identify them instead of differentiating them by shape or colour is a faster and more efficient process. This can be easily achieved by using a detection and segmentation algorithm. In this Project, the user has the option of using a QR code to track and identify.

Based on the Threshold method of segmentation, it is used to differentiate objects by their colour. This method uses a bandpass filter and applies it to each pixel in the image. Those pixels that are within the range defined by the user will return a value of 1 (white color), while those that are outside will return a 0 (black color). Finally, the object is pictured on a black background. An example can be seen in figure 2.



Figure 2 Object detection by colour (blue).

Through this technique, the MV system can discern the contour of an object. To do this, two conditions are programmed: in the first, the contours with an area less than 20 pixels are discarded to eliminate the effect of noise. In the second, any non-closed contour is also discarded.



Figure 3 Object detection by contour.

To obtain the spatial information of the objects, it is necessary to know their coordinates (x,y) within the captured image. When tracking objects using code identification, the coordinates of the object contour and the code inclination are obtained (Fig.4), so that position and orientation can be calculated. When identifying objects just by colour or contour, only the position of the object and the coordinates (x,y) of the centre of mass are determined (Fig.5).

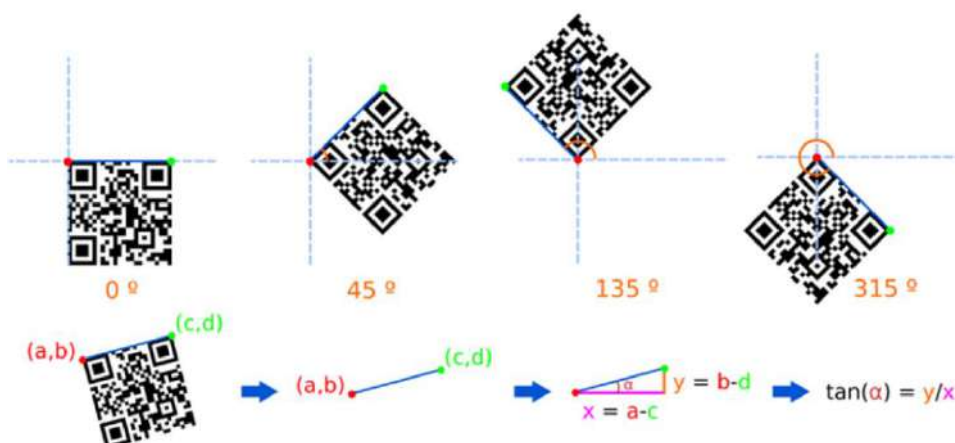


Figure 4 Code orientation calculation.

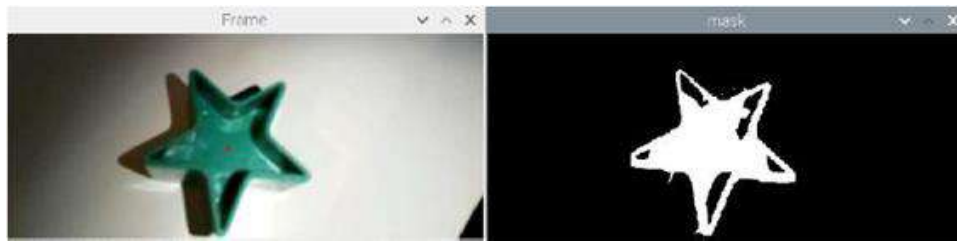


Figure 5 Center of mass calculation (red spot).

3. Development of a spreadsheet application for the design and calculation of switched-mode BOOST converters.

Electronic devices in domestic or industrial environments require a direct current (DC) supply. However, the power supply system commonly available in our installations is alternating current (AC). Therefore, an element that is present in any equipment is an AC to DC converter with a DC to DC converter to adapt the AC power signal to the type of power supply and range required by the electronic circuitry of the device.

Therefore, power converters are fundamental circuits. Their main task is to adapt different electrical magnitudes, such as voltage and current, to be used in countless domestic and industrial applications. Depending on the nature of the signals they convert (AC or DC), there are different families of converters such as inverters, AC to DC converters or DC to DC converters. Furthermore, within each family and according to the type of transformation they perform on the electrical parameters, they can be basically classified as step-up or step-down converters, among many others.

In many applications it is necessary to control the characteristics of a DC signal in order, for example, to increase the value of its voltage [4,5]. Converters that perform this control are known as boost converters, which increase the voltage value of the input signal to the desired value of the output voltage. Due to their wide applicability, the design of boost converters is a frequent task for any electronic designer [6]. In this context, the development of software tools to accelerate the design of boost converters also provides greater efficiency and depth of analysis [7,8].

In this context, the project "Development of a spreadsheet application for the design and calculation of switched-mode BOOST converters" is framed. Through it, the author has implemented an intuitive software tool that significantly facilitates the design of boost converters for any type of application.

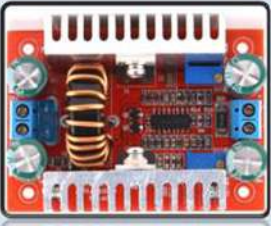
The design tool consists of a spreadsheet that performs the calculations combined with a Visual Basic graphical interface that allows the user to enter data and display the design results. For example, through the graphical interface, the user provides the data relating to the input of the converter, as well as the parameters of the commercial electronic components (such as transistor, diode, capacitor...). Figure 6 shows some examples of data entry screens.

7.F.6
Curso 2020-2021
José María Benito Galán

DISEÑO DE UN CONVERTSOR CONMUTADO TIPOLOGIA BOOST

DATOS DE ENTRADA

Tensión monofásica de línea:	V_{in}	=		V
Error de la tensión de línea:	δ	=		%
Frecuencia de la línea:	f	=		Hz
Tensión de salida DC:	V_o	=		V
Mínima potencia de salida:	$P_{o\min}$	=		W
Máxima potencia de salida:	$P_{o\max}$	=		W
Frecuencia de conmutación de los interruptores:	f_s	=		Hz
Máximo lizado en el condensador de entrada:	α	=		%
Sobredimensionado de los semiconductores:		=		%



Parametros **Calcular** Borrar Cálculos Informe Graficas Esquema

DISEÑO DE UN CONVERTSOR CONMUTADO: BOOST

DATOS POR DEFECTO

Valores por defecto
 Introducir valores el usuario

CONDENSADOR DE SALIDA: C_o (SIN ESR)

% respecto a la tensión de salida: % Defecto

CONDENSADOR DE SALIDA: C_o (CON ESR)

Condensador:	C	=	470E-6	F	Defecto
ESR:	ESR	=	55E-3	Ω	Defecto

BOBINA: L

% respecto a la corriente de la bobina: % Defecto

Inducción de saturación de las ferritas: B_{SAT} = 250E-3 T Defecto

Densidad máxima de corriente en el cobre: J_{CuAx} = 4 A/mm² Defecto

Factor Topológico de corriente: K = 0,7 Defecto

Diametro del conductor (Hilo de Litz): d = 0,6 mm Defecto

NUCLEOS NORMALIZADOS	A_w (mm ⁴)	A_c (mm ²)	A_w (mm ²)
ETD29	6.840	76	90
ETD34	11.943	97	123
ETD39	22.125	125	177
ETD44	37.022	173	214
ETD49	67.603	211	273
Otro			

Figure 6 Data entry screens.

Based on the data provided, the program calculates all the parameters of the converter for a continuous conduction regime, including the voltage and current ripple, the duty cycle variation or the efficiency of the converter, among many others. An example of the results interface is shown in figure 7.



Figure 7 Examples of the results interface.

In addition, it also allows the design of the magnetic core, snubber networks and radiators for heat dissipation. And finally, it performs the design of the closed control loop considering the use of the integrated PWM signal generator UC1825. Figure 8 shows additional examples of the results interface.



Figure 8 Additional examples of the results interface.

From the above, it can be concluded that the author has managed to develop a very powerful, intuitive and highly configurable converter designing tool. In this way, the implemented software tool has a high applicability for electronic designers of any field.

4. Irrigarden efficient system project.

The Irrigarden Efficient System Project is a teamwork related to the Development and Sustainability Goals (ODS). In the first place, the team defined the challenge based on the evidence collected and derived from the processes of observation, interviews, data

analysis, application of creativity techniques and design thinking. Because of this, is proposed the design of an automated irrigation system using a microcontroller. The developed system allows the monitoring and automation of public green areas in a small city, with the aim of reducing water consumption, staff travel expenses and associated energy costs. For this, different sensors will be used to measure the humidity of the earth, the temperature, amount of water used, ultraviolet radiation, etc. In addition, the generated data will be sent to a web server that will collect and display the information of the different parameters in each green area. With these data, the opening/closing of solenoid valves will be controlled to carry out efficient irrigation of parks and gardens, reducing water consumption, staff travel expenses and the associated energy costs. The figure below shows the connection scheme of the developed system.

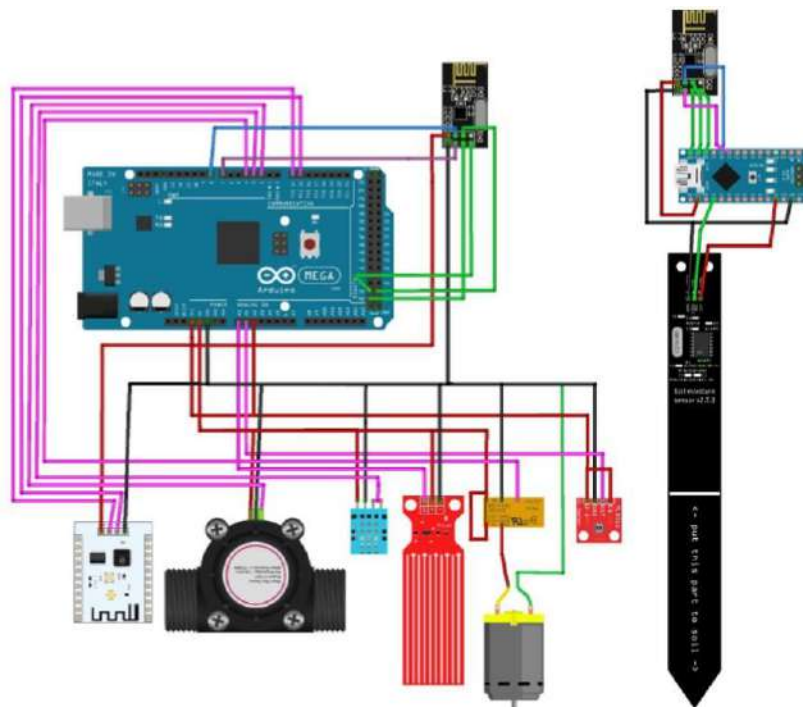


Figure 9 Irrigarden efficient system project scheme.

A scale prototype has been assembled to test the effectiveness of the developed system. This prototype consists of a main station that collects all the information from the substations, processes it and makes decisions. It will also send the data to the web so that they are registered. The figure below shows the main station.

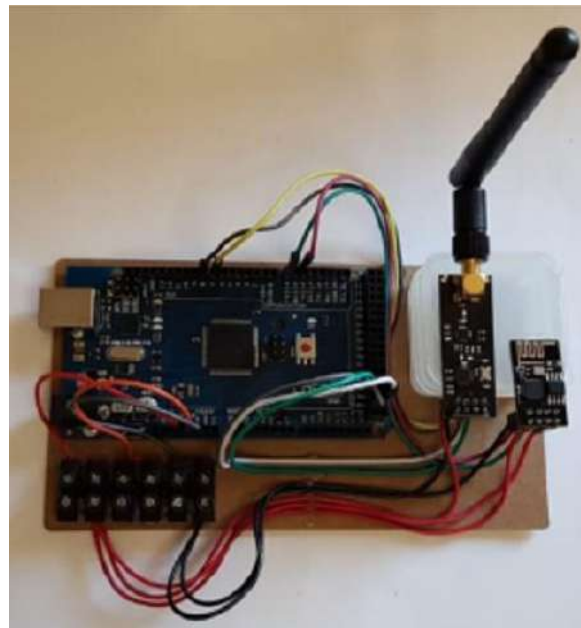


Figure 10 Main station.

There is also a substation to measure the humidity of the earth and wirelessly send the values obtained to our main station. Subsequently, the main station will decide whether to turn on or keep turn off the irrigation system. The figure below shows the substation to measure the humidity of the earth.



Figure 11 Substation in real set.

Additionally, a second substation has been implemented to measure the humidity and temperature of the environment, sending the values obtained to our main station by wire. The figure below shows the substation to measure the humidity and temperature of the environment.

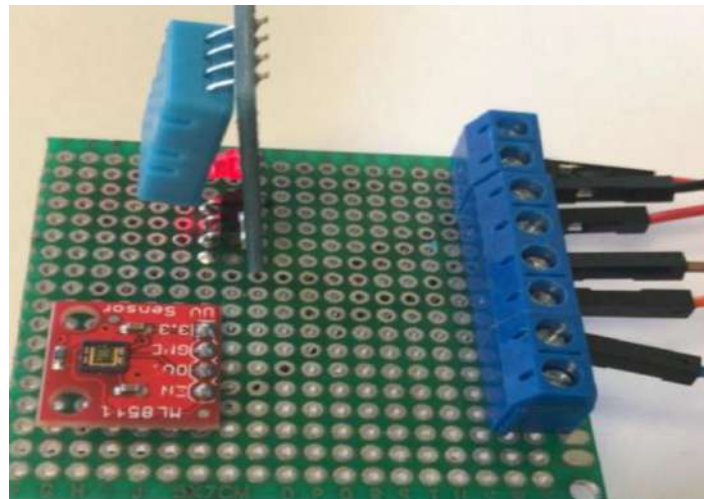


Figure 12 Humidity and temperature station.

5. Solar-F project

The Solar-F project is part of the development of Integrated Projects (IP) that Florida Universitaria has been implementing since 2011-12 academic year and which, in the third-degree year, consists of providing a professional solution to a problem or real need proposed by a company, entity or organization related to the degree. [9]

Its completion is mandatory for all students enrolled in more than thirty credits in the third year of Industrial Electronic and Automatic Engineering Grade. It is carried out by teams made up of 5 to 7 students and configured at the beginning of the course by the project coordinator.

All the teaching staff of the course participate in a coordinated manner in the project and its management corresponds to the coordinator of the IP. Each subject plans its objectives to be developed in a flexible way, depending on the problem to be solved in each course. The volume of participation for each subject is 25% in terms of final evaluation.

The Solar-F project has as its general objective to work on general and specific skills of the Industrial Electronic and Automatic Engineering Grade, following the PBL methodology. During its preparation, students also develop transversal skills, among which the following stand out: teamwork, lifelong learning, conflict management through negotiation and decision-making.

The specific objective of the Solar-F project is the design and implementation of a solar tracker system to obtain a regulated voltage of 5V in the most optimized way possible. Each group of students must generate a written technical report that details the solutions adopted for the design and manufacture a prototype, they must also make an oral presentation where the virtues of design are presented, questions from an evaluating court are answered and, finally the functioning of the developed prototype must be shown.

In the first semester (first stage), a DC-DC converter (buck converter) has been developed, where from a controllable power supply the output of a photovoltaic panel system has been simulated. Being capable of regulating the input voltage variable,

obtained from the photovoltaic system, so it provides a constant voltage of 5V (max.1A) with the highest possible energy efficiency.

In the second semester (second stage), a micro-controlled tracking system adapted to a supplied photovoltaic solar panel has been implemented, where the system must know the panel orientation and make the necessary corrections in order to respect to the position of the Sun as it moves.

Next figure graphically shows the systems to be implemented in both stages which are linked to the third-year subjects of Industrial Electronic and Automatic Engineering.

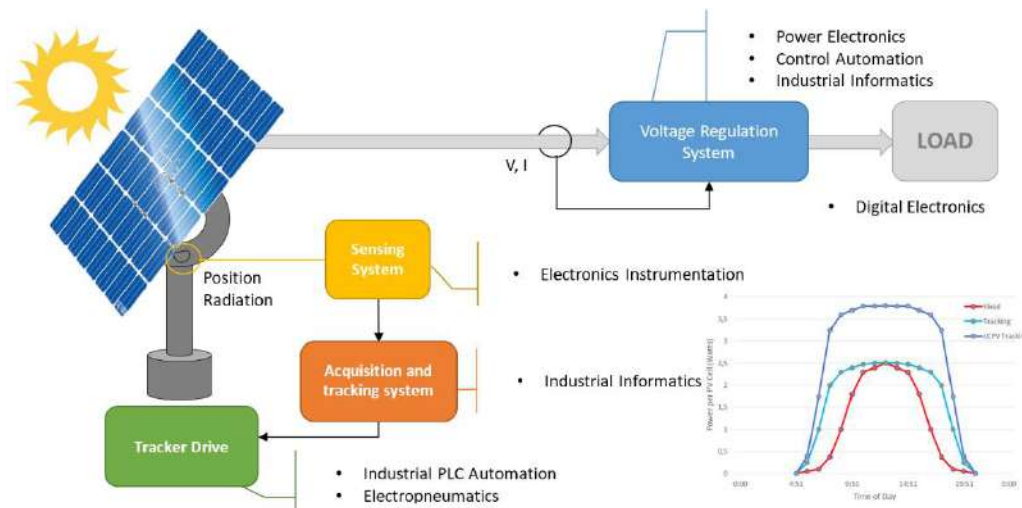


Figure 13 Systems to be implemented for the Solar-F project.

Regarding the timing of both stages, it is worth to mention that, although the core work of implementing the designs is carried out the last 15 days of each semester, during the rest of the time, the students carry out seminars to complete the previous technical knowledge that could be necessary, among which can be mentioned:

- Technical seminars: electronic circuits designing and prototyping, SMD soldering workshop, digital signal filtering and processing.
- Specific technical seminars: photovoltaic energy, solar tracking techniques and algorithms, power converters control design and modeling, position control, communications...

During the last two weeks of each semester, there are no classes, understood in the traditional way. The teams come to the laboratory on a flexible schedule, although the teaching staff is available guiding those teams that request their help.



Figure 14 Students implementing the solar panel with tracker.

At the end of each semester, the teams present their converter prototypes to the evaluation court, exposing the most significant aspects related to their development, answering individually to the questions asked and showing the proper functioning of said prototype.

The following figure shows images of one of the designed prototypes and its defense in the evaluation act.



Figure 15 Presentation of one of the designed prototypes.

The development of the Solar-F project has made possible to work on transversal skills through the project-based learning methodology. Also it has made possible to integrate the co-evaluation or peer evaluation of students, since they have worked as a team for a long time during the school year. On the other hand, the link between the students and the company, which was ultimately the client who demanded the design of the prototype, has been encouraged.

From the point of view of the subjects, Solar-F project has contextualized the application of knowledge and has served as an accolade to the usefulness of the training received, which is so difficult for students to identify.

The practical development, facing an open problem, greatly contributes to the establishment of basic engineering concepts that sometimes go unnoticed. Empirical work has provided students with a know-how that results in significant learning [10] that will surely be useful for their future professional performance.

The BPL methodology oriented to electronics system designing and prototyping makes possible to demonstrate the problem-solving process in engineering: design, development, simulation, implementation and validation.

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SYSTEMATIC OBSERVATION APPLIED TO A CASE STUDY FOR THE EVALUATIVE ANALYSIS OF PARTICIPATORY INSTRUCTIONAL INTERACTION IN UNIVERSITY EDUCATION

Héctor Tronchoni

Florida Universitaria / Universidad de Valencia, Valencia, Spain
hector.tronchoni@florida-uni.es

Conrad Izquierdo

Universidad Autónoma de Barcelona, Barcelona, Spain
Conrad.Izquierdo@uab.cat

M Teresa Anguera

Universidad de Barcelona, Barcelona, Spain
tanguera@ub.edu

Abstract. Introduction The purpose of this presentation is to share the possibilities of a conceptual and methodological approach based on a systematic observation design that incorporates the advantages of mixed-methods. The subject studied is the analysis of participatory instructional interaction in the university classroom. **Method** Systematic observation is applied to a case study (ID:C3_S2_MEX) of expository class posed as an idiographic, intrasessional follow-up and multidimensional design (I/F/M) in the natural context of a class about education at the master level and taught by a teacher to a group of students. The observation instrument built combines the field format with category systems, and includes the two core processes: interaction and participation. Record is carried out using the free LINCE program, and the intraobserver agreement is passed using Cohen's kappa coefficient (1960). **Results** The lag sequential analysis and polar coordinates analysis are conducted after the data have been collected, and the interpretive and formative value of the methodological procedure applied is assessed. **Discussion and conclusions** The value of the systematic observation methodological procedure is evidenced when interpreting the results obtained to answer the research questions and propose training criteria that guide the improvement of participatory interaction with a strategic function for meaningful learning.

Key words: *systematic observation, participatory interaction, mixed-methods, lecture, university education*

1. Introduction

In a more or less distanced way from the so-called university lecture, the new expert expository classes deserve to be observed and valued (Gatica-Saavedra, 2020; Tronchoni, 2019). Expert classes are being transformed (Darling, 2017; Buzzanell, 2017) introducing important changes in the way of managing attention times in oral reception (Monk & Newton, 2018; Sarihan, 2016), in the use of computational and audiovisual devices when sharing extensive packages of information (Zarraonandia et al., 2013; Hegeman, 2015), in the pauses that become another type of nested activity, more practical than expository (Chimmalgi, 2019) and, finally, in its use as a virtual session format (Matthew, 2020; Vázquez & Chiang, 2016). There is no doubt that each

of the changes listed is good news for innovation committed to the quality of teaching in postgraduate studies. But, we suspect that the new ways of executing the expert expository format may continue to be contaminated by the classic idea that *listening is not talking* (Jafariyan et al., 2017; Miller & Schraeder, 2015).

The script *listening is not talking* would lead us to observe expert-enhanced expository sessions as a one-way exchange moment in which the silence of the audience only confirms that the speaker can continue speaking until the magic of silence is broken. Instead, in the communication that we present we offer a conceptual-methodological model based on the complex concept of participatory interaction that we have modeled to be able to be observed in the dimensions that we consider in the course of the expert presentations (Tronchoni et al., 2021).

With our empirical contribution we aim to:

1. Share the depth of expert intra-turn exchanges and their role in adjusting instructional exchanges;
2. Share the evidence on the dialogic links of strategic cooperation;
3. Assess together the reasons that we expose to recommend the training in course of all those involved in the way of preparing and carrying out the classes with a participatory interaction format in expert expository mode.
4. Highlight the important role played by the systematic observation methodology as a powerful tool for evaluating and training the skills that are necessary to make effective, goal oriented and efficient use of the time dedicated to the production of shared knowledge, locating, giving meaning and elaborating the regulated contributions of the expert and the *silent* contributions of the audience.

2. Systematic observation of participatory interaction

As we have stated in other works (Tronchoni et al., 2018, 2021), the participatory purpose of the interaction in the instructional context of expert expository sessions is based on becoming aware of the importance of preparing and conducting the lecture as a cooperative exchange, in terms of listening, and collaborative in the dialogical production of knowledge.

Feeding reciprocal attention in the series of exchanges that are part of the silence required to start giving-receiving academic material entails illuminating the field of what moves in a preferably visible way, but also audible, as signals that come from both poles of the interaction and alert, moment by moment, about the state of the motives to cooperate in listening to the other. The expert speaker, while speaking, listens in the background to the audience and the audience flashes multimodal signals to communicate how they receive the speaker's intervention and offer reasons to continue shaping, modulating or turning the direction, content and form. of what he says and moves (Hyland, 2005). Indeed, this communicative link that occurs moment by moment is the result of the encounter between the *voice of silence* of the listening participants and the silence provided by the expert speaker materialized in the use of internal and/or external pauses. In summary, the organization and detection of communicative signal traffic that inform about the connection status of participatory interaction is the first dimension that we can address as a systematic observation problem.

The second dimension to observe systematically has to do with the dialogic links aimed at generating conditions of autonomy for individual or small group study of the subject matter of instruction. The teaching efforts committed to the asymmetrical and highly specialized situation of the expository sessions of experts in postgraduate and doctoral studies, are intended to train the audience in the task of studying the subject. The range of discursive resources today has expanded with the identification of a wide variety of learning strategies that are used in different instructional situations (Coll & Onrubia, 2001; Cubero et al., 2008; Ruiz et al., 2010).

In terms of structuring the empirical procedure followed, systematic observation as a methodology that addresses the complementarity and integration of quantitative and qualitative analysis with qualitative data (Anguera *et al.*, 2020), has made it possible to describe and assess the expert expository sessions from beginning to end as a problem articulated by the two dimensions indicated above: i) the reasons for collaborating in *give and receive* and (ii) the strategic dialogical cooperation that is necessary for the production of knowledge that facilitates personal study about the topic.

The choice of this methodology has made it possible to identify significant patterns with an organizational function of the communication process facilitating training for personal study. A powerful and robust quantitative analysis, together with its possibilities of graphical representation, adds to the rigor of the research process followed, the presentation of solid evidence with socio-professional meaning, that is, they are useful results for the training of all those involved. Note that the set of possibilities in the quantitative analysis of qualitative data following the temporal order of the events is not exhausted with the applied sequential analysis.

Finally, the decisions made to implement the methodological structure for the Case ORI are summarized in Table 1:

Table 1 Decisions made to implement the systematic observation (Case ORI)

Criteria	Methodological decisions
Participants and scene	Teacher and 10 students (3 men and 7 women) Subject: Fundamentals of Educational Counselling Session duration: 1h. 31' 14" Master in Pedagogy Popular Autonomous University of the State of Puebla (Mexico)
Observational design (Anguera <i>et al.</i> , 2001)	Idiographic (the unit is the interactive behaviour of the teacher) Punctual with intrasessional follow-up from beginning to the end Multidimensional (incorporation of different dimensions)
Registration instruments and analysis	Programme LINCE (Gabin <i>et al.</i> , 2012) Programme GSEQ5 (Bakeman & Quera, 2011) Programme HOISAN (Hernández-Mendo <i>et al.</i> , 2012) Programme R (Rodríguez-Medina <i>et al.</i> , 2019)
Observational instrument	LUniMex-2017 (Tronchoni <i>et al.</i> , 2018)
Data quality control	Kappa >0,90 (Cohen, 1960)
Analysis	Lag Sequential Analysis (lags 1-10) Polar Coordinate Analysis

3. Examples of some results obtained

The multidimensional and temporal structure of the field format specified in the LUniMex-2017 observation instrument has allowed us to capture the regularities of the instructional communicative dynamics. We have assumed that the oral instructional communication process depends both on the recursive movement of multimodal interactions between the expert speaker and the audience and on the discursive or interactive supports provided by the speaker according to the situation in which the cognitive-affective adjustment indicator is found within the turn of the expert speaker and the *silent* interventions of the listeners, and when the alternation in the speaker's turn occurs on some occasions. Thus, we highlight the following sequential patterns:

a) Shared management of the *give-receive information* adjustment: the function of the cooperation links keep the participants connected (channels in "on") with the aim of facilitating the approach to the issues.

ORI directs its exhibition focusing on the attentional space of the different areas considered in the classroom, in such a way that, without interrupting its talking turn, it has repeatedly exchanged recognition signals in a natural and non-invasive way. Regardless of how the function of this pattern is valued in its context, we can accept that it can be considered as an inclusive behaviour and recognition of the ability of the audience. Tables 2 and 3 indicate the criterion behaviours and the conditioned behaviours, the adjusted residuals are presented, indicating the level of significance and the significant links with a cooperation function are named:

Table 2 Example of significant adjusted residuals corresponding to lag sequential analysis

Denomination												
Dialogical link of the direction of action with intra/inter turn alternation: QaQ												
Criterion behaviour	Conditioned behaviours	Level of significance	R1	R2	R3	R4	R5	R6	R7	R8	R9	R10
DA	DG, GD DE, ED DEo, EoD DEa, EaD	0.05	DG	ED	DG	ED	DG	ED	DG	ED	DG	ED
			5.87	2.98	5.33	3.31	4.86	3.63	3.93	02.05	3.69	02.02

Table 3 Example of significant adjusted residuals corresponding to lag sequential analysis

Denomination												
Dialogic link between the direction of the action and the role of the use of the word												
Criterion behaviour	Conditioned behaviours	Level of significance	R1	R2	R3	R4	R5	R6	R7	R8	R9	R10
DA	HA,HI,OA,O	0.01	HA	HI	HA	HI	HA	HI	HA	HI	HA	HI
			5.5	2.32	5.19	2.33	5.42	3.43	4.73	2.89	4.5	2.63

b) Strategic dialogic links promoted by the expert speaker: The intellectual-affective function of these links is to facilitate and make visible the indications integrated in the expositive lecture on the convergence of the processes of connecting with prior

knowledge, giving meaning and elaborating academic knowledge when his personal study undertakes.

Table 4 and Figure 1 include and represent the parameters corresponding to the significant vectors when giving (DA) is the focal behaviour and all those that integrate the second dimension are conditioned. The vectors obtained indicate that: a) *asking for-giving information* actives and is activated by the categories of sharing prior knowledge, individual experiences, contents and procedures in progress while forming a close-cold socio-affective and cognitive exchange and b) when the state of the lecture is characterized by an exchange of socio-affective and cognitive signals that define a close-warm relational space, the probability that the group is incorporating, elaborating or sharing information is very low for this observed exposure.

Table 4 Example of parameters corresponding to the analysis of polar coordinates, where DA is the focal behaviour (only those corresponding to significant vectors in the length of the vectors)

Category	Quadrant	Prospective	Retrospective	Ratio	Length	Angle
		P.	P.			
CIN	I	2	4.34	0.91	4.77	65.27
EIN	I	1.43	1.79	0.78	2.3	51.37
CEC	I	2.75	0.48	0.17	2.79	9.81
IPF	I	1.12	2.48	0.91	2.72	65.76
IDC	I	2.68	0.82	0.29	2.8	16.95
CCO	III	-5.34	-3.35	-0.53	6.31	212.06
ICO	III	-2.64	-1.01	-0.36	2.82	200.88
IPC	III	-3.39	-0.48	-0.14	3.42	188.1
REE	III	-2.42	-4.35	-0.87	4.98	240.95
CAM	IV	2.38	-0.69	-0.28	2.48	343.77
SIN	IV	1.93	-0.53	-0.27	2	344.56
IDF	IV	1.27	-3.41	-0.94	3.64	290.41

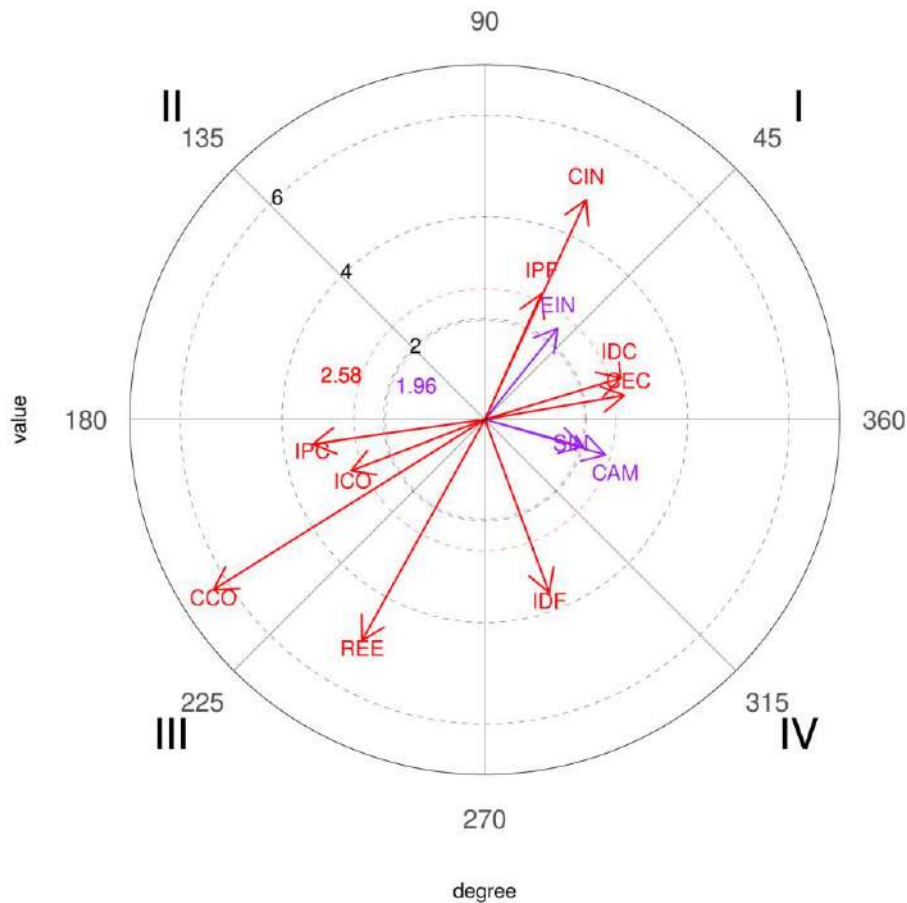


Figure 1 Example of significant vectors corresponding to analysis of polar coordinates, where DA is the focal behaviour.

4. Conclusion

From an applied point of view, in the ORI case, the recognition of the capacity of the audience and the maintenance of attention through the role of the participants in the use of the word fits with the rules of the expository format and its instructional function without fall apart; and collaboration is defined through the strategies of connecting with prior knowledge, making sense of the lesson, and building the knowledge needed to engage in personal study of the topic.

The regulation of participatory interaction in the ORI case can be enhanced through an improvement plan that incorporates the use of guided self-observation as a means to reflect on the strong and weak aspects in the articulation of communication and instruction processes, without forgetting the disciplinary context of the subject and taking into account the aspects related to trust and shared instructional commitment among all those involved, through: evaluating the sessions, editing a video report for self-observation, individualized supervision of self-observation, participating in a discussion group to share the results of self-observation and, in parallel, a seminar or workshop to work on trust and collaborative commitment.

In summary, the systematic observation methodology serves as a powerful tool for evaluating and training the skills that are necessary to make effective, goal oriented

and efficient use of the time dedicated to the production of shared knowledge, locating, giving meaning and elaborating the regulated contributions of the expert and the *silent* contributions of the audience.

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SERIOUS GAMES AND EDUCATIONAL STRATEGY: BROKERMANÍA AN INITIATIVE TO CREATE AND ENRICH PROFESSIONAL AND SOFT COMPETENCES.

Broz Lofiego, Adrián

Florida Universitària, Spain
abroz@florida-uni.es

Pastrana Esteban, Héctor

Florida Universitària, Spain
hpastrana@florida-uni.es

Abstract. Accelerated change and digitalisation have completely transformed the professional and personal skills required for rapid entry into the labour world. To respond to these needs, secondary education, vocational and educational training, and university education have been confronted with the need to change the way competences are created and improved. In this context, gamification has become an ideal tool. This paper presents a case of the implementation of serious games applied to educational strategy: The Brokermanía Contest, an initiative developed by Florida Universitària, which in 2022 will reach its fourteenth edition, with the aim of creating and enriching the professional and soft skills of its students. Part of the success of this initiative is related to the increase in extrinsic motivations generated. Given the multiple benefits associated with this methodology, the experience should be extended to other thematic content, making the use of gamification in education more frequent. Additionally, it would be of great interest to study in the future the role of flow as a central element of intrinsic motivations.

Key words: *Brokermanía; Gamification; Innovative Practices in Education; Soft & Hard Competences; Financial Markets.*

1. Introduction

The old model of knowledge transmission is no longer adequate in the 21st century; within the framework of an integrated and knowledge-based society, there has been an increase in cognitive and competences requirements aimed at satisfying labour and professional demands (Prieto-Martín et al., 2014; Borden, 2021; Erdman et al., 2022). The application of strategies that integrate conceptual elements of game design (“serious gamification”) into education aims to motivate and involve students in the acquisition of skills that complement their curriculum. While it is true that gamification has been gaining ground in business administration, marketing and corporate strategies, its application to education still constitutes an innovative strategy (San Miguel et al., 2016; Borden, 2021; Comeig-Rodríguez & Sendra-Pons, 2021; Beranič & Heričko, 2022).

Aware of these reality, Florida Universitària introduced the Brokermanía Contest, a game that adequately mixes fiction and reality. Brokermanía is a simulation game where higher education, vocational and educational training (VET) and secondary school students transform themselves into brokers for a period of eight weeks.

The aim of the competition is to stimulate interest in the stock market among students at educational centres. Participants had to look for suitable information for the purchase and

sale of equities, using innovative technologies, which allows for much greater interactivity and a change in the way of making decisions on the acquisition of stock market securities.

This serious game created by Florida Universitària introduces new methodologies in the learning process of students who are about to enter university or take the leap into the world of work. During the two months of competition, through this stock market game, Florida Universitària encourages the development of skills such as observation, initiative, research, synthesis of information and decision-making.

The objective of this paper is to share an innovative learning experience and to assess the effectiveness of gamification as an alternative motivating strategy in the process of acquisition of competences in economics and finance. After the introduction, we analyse the most important educational gamification strategies and their impact on the acquisition of competences. Subsequently, we show the design elements of the Brokermanía Contest and the results of applying this methodology. Finally, we include main conclusions, the strategic implications, the limitations, and the proposed lines of future research.

2. Serious Games, Extrinsic & Intrinsic Motivations

According to Erdman et al. (2022) "global competition and digital market forces imply opportunities and threats in an increasingly fast and competitive job market. In this context, motivated learning through collaboration or cooperation have been extensively studied to develop necessary skills to be competitive" (pp. 76).

Originally, the term gamification originated in the digital media industry; over time, this concept has gained wide acceptance and research work related to the subject and applied to multiple disciplines, such as business, marketing, and education. Gamification as a concept is a recent expression in the academic literature related to pedagogy, having been documented for the first time in 2008 (Martí-Parreño et al., 2016).

Gamification can be defined as the application of conceptual elements of game design (mechanics, aesthetics and thinking) to non-game contexts and in non-game settings (Deterding et al., 2011; Prieto-Martín et al., 2014; Serna et al., 2016). Gamification is based on one of the motivation theories born between the mid-1980s and the beginning of the new century: Self-Determination Theory (Deci et al., 1981; Deci and Ryan, 1985; Deci and Ryan, 1987). This theoretical model seeks to explain the reasons why there is an intention to conduct a behaviour and why it is carried out. Deci and Ryan (1985 and 1987) focus their attention on the existence of two types of motivations to perform a behaviour: i) extrinsic motivations and ii) intrinsic motivations.

Extrinsic motivations are defined as "performance of an activity because it is perceived as instrumental in obtaining outcomes that are distinctive to the activity itself, such as improved performance within the work activity, greater monetary rewards, or promotion within the organisation" (Davis et al, 1992; p. 1112). Intrinsic motivations, on the other hand, relate to the performance of an activity without any reward other than the enjoyment or exhilaration of performing the activity. This does not mean that the activity does not have other rewards associated with it, although this is a secondary element (Deci and Ryan, 1985; Deci and Ryan, 2011; Deci and Ryan, 2012).

In the case of gamification and its relation to motivational theory, examples of extrinsic motivations include aspects such as obtaining prizes and/or achieving a score and/or completing the game. Intrinsic motivations are associated with gaining greater autonomy, achieving conviction, and deepening interest in an area of knowledge. While both types of

motivations are relevant, Borrás-Gene et al. (2016) stress the importance of intrinsic motivations in gamification; it is especially important that the activity receives a reward "in" and "for" itself, independently of others that may satisfy the participants.

In the field of education, Serna et al. (2016) show that games are a methodology that favours the establishment and internalisation of concepts taught, that makes the learning process active and that allows the integration and linking of content in a way that is attractive to students. By using the elements associated with the world of games, educators turn the classroom itself into a game, in which rewards are introduced, badges are distributed, leader boards are created, and competitive dynamics are presented, which transforms the dynamics and the teaching and learning process (Martí-Parreño et al., 2016). In addition, gamification is a motivating approach, which increases dedication, improves the predisposition to acquire skills derived from the different subjects and favours action, active learning, autonomy, and problem-based learning (Sousa-Borges et al., 2014; San Miguel et al., 2016; Serna et al., 2016; Borden, 2021; Comeig-Rodríguez & Sendra-Pons, 2021; Beranič & Heričko, 2022).

Gamification and the associated positive effects are a counterpoint to the shortcomings associated with the traditional teaching and learning model. Prieto-Martín et al. (2014) state that traditional university education is pedagogically based on the master class (where the first exposure to knowledge occurs in a classroom with expository methodology), learning is produced or consolidated through out-of-class study and is very focused on the use of memory, all of which is very boring; without taking into account that students are faced with a traumatic experience such as the final assessment, the consequences of which are drastic. This model also does not encourage feedback and does not contribute to a personalised approach to learners.

Serna et al. (2016) argue that gamification experiences favour the adoption of new ways of thinking, feeling, and acting, the ultimate goal of which is student motivation, which in turn translates into an increase in intrinsic motivation and has a direct, positive impact on the number of passes. Besides, gamification exploits both extrinsic and intrinsic motivation mechanisms, and two layers can be distinguished: i) the thin layer, which is added to a system and provides some training through prizes, bonuses, and other short-term rewards, and ii) deep gamification, which aims for a high level of involvement, increasing the epic or narrative feeling that appeals to intrinsic motivation (Prieto-Martín et al., 2014). A well-planned subject, which presents a compelling and engaging storyline, increases deep gamification and the associated positive effects. Prieto-Martín et al. (2014) consider that "the incorporation of gamification strategies in education aims to incorporate those characteristics of video games that encourage players to continue playing, thus encouraging learners to perform actions that lead them to learn and to remain involved in their learning process" (p. 76).

Within the study of finance and investment theory, gamification has enormous potential, being able to simulate, with great realism, the process of choosing stock market securities, their incorporation into an investment portfolio and the transformation of students into portfolio managers. This is where Brokermanía, Florida Universitària's experience, which we will describe in the next section, comes in.

3. Brokermanía Contest: The Future Through a Serious Game

The term gamification refers to the use of game design elements in alternative contexts to increase people's engagement in a variety of tasks (Sousa-Borges et al., 2014). While it is true that gamification and its principles have been gaining ground in business administration,

marketing and corporate strategies, its application to education is still an emerging strategy (Dicheva et al., 2015).

Aware of these changes, and within the innovative learning strategies proposed by Florida Universitària, is the Brokermanía Contest, which appropriately mixes fiction and reality. It is a simulation game in the stock market, where students become brokers, managing a virtual portfolio of equities through the Internet. The main goal of the competition is to motivate students, in a playful way, to broaden their basic knowledge of economics and finance, to think about their own financial planning and to exercise their ability to deal with risk, uncertainty and doubt. At the same time, Brokermanía develops teamwork and cooperation skills and enables students to discover emerging job opportunities.

With Brokermanía, Florida Universitària takes gamification to the educational-professional sphere to bring students closer to knowledge in the financial sector and strengthen skills such as leadership, information management or conflict resolution, among other objectives. Florida Universitària's serious game introduces new methodologies in the learning process of students who are about to enter university or take the leap into the world of work.

The proposed game requires students to search for information that justifies the operations, while at the same time developing skills that are essential in the real world, such as observation, initiative, the search for and synthesis of information and decision-making. The competition uses modern technologies as a tool, which is highly interactive and stimulating, and at the same time prepares students in skills that will be essential when they enter university or the labour activity.

Brokermanía is a fun and engaging game that increases dedication, willingness, action, active learning, and autonomy, combining intrinsic and extrinsic motivations. The extrinsic motivation is related to win the tablet PC and being recognized by the rest of the students and the society, while the intrinsic motivation is related to the concept of flow.

Flow is a psychological state in which people are completely absorbed in their activity, in which nothing else seems to matter. People who experience flow feel strong, alert, in great control of the situation and at the peak of their abilities (physical, psychological, and cognitive); irrelevant perceptions and thoughts become indifferent, problems seem to disappear, there is an exhilarating sense of transcendence, and one loses one's awareness and sense of time (Csikszentmihalyi, 1975; Csikszentmihalyi, 1990; Csikszentmihalyi, 1997; Csikszentmihalyi et al., 2014). When people experience flow, they tend to continue to engage in an activity, although when this feeling disappears, they become irritated, bored and discontinue what they were doing (Csikszentmihalyi, 1993).

Nakamura & Csikszentmihalyi (2014) assert that flow, by providing intrinsic reward, leads individuals to want to replicate the experience in the future, introducing a selective mechanism within psychological functioning that leads to personal growth. Individuals can experience a sense of flow in many contexts: athletes, musicians and artists can be cited as performing their activities at the limit of possibilities, but nevertheless enjoying it (Csikszentmihalyi, 1975; Csikszentmihalyi, 1990; Csikszentmihalyi, 1997).

Independently of motivations existing, Brokermanía Contest also allows participants to make mistakes, which is a natural part of the learning process, taking away the sense of anguish. For its part, play harmoniously combines individual and group learning, favouring

socialisation. Finally, Brokermanía incorporates ethics and individual commitment, as it makes participants think about what behaviour is allowed versus what is not.

4. Main Features of Florida's Brokermanía Contest

4.1. Categories & Participants.

Florida Universit ria's Brokerman a Contest, which in 2022 celebrates its fourteenth edition, is an innovative learning experience, whose main goal is to motivate students, in a playful way, to expand their basic knowledge of economics and finance. The competition also aims to help participants develop skills in finding the accurate financial information for buying and selling shares, using new technologies as a medium, which allows for much greater interactivity and a change in the way decisions are made.

In the contest, two categories, A & B, are established:

Category A: Secondary school students, and students from vocational and educational training (medium and upper levels) from all over the Valencian Community.

Category B: Secondary school students, students from vocational and educational training (medium and upper levels) and university students from Florida Universit ria.

In both categories, the first prize receives a Table PC while second and third prizes receive a certificate diploma. To participate, students must complete a registration form on a link provided for this purpose, which requires the email address and telephone number of each candidate, which is essential when communicating with those who win the competition in each category. Each participant can only register once, and any duplicate entries will be deleted.

4.2. Operational Aspects & Development

- Each participant will have a fictitious  50,000 to invest in the stock market during an 8 weeks-period.
- Trading of securities may only be made in IBEX 35 and in the continuous market.
- The time that must elapse between a purchase and sale of the same security should be more than one hour.
- Transactions may be made at any time of the day or night and participants can make as many trades per day as they wish. However, transactions made after the close of the market shall be carried out at the closing price on the same day.
- The minimum number of trades to be made will be ten buy trades and ten sell trades during the length of the contest. This clause allows to avoid the appearance of adverse selection and moral hazard behaviours.
- The jury of the competition is made up of lecturers and professionals from Florida Universit ria. From the beginning, participants are informed that Florida Universit ria reserves the right to withdraw from the game those who incur in bad faith actions, as well as the total suspension of the game.
- At every moment of the competition, each participant can consult his/her financial information (investment portfolio, up to date performance, position in the ranking of players). Updated information allows participants to guide his/her decision-making process.

Participants conduct share trading operations through an IT tool / platform provided by Renta4. This tool can be accessed at any time from any computer with an Internet connection. Through this platform, participants can buy and sell equities, while at the same time be

informed about all operations done since the beginning of the contest. Updated information about profits and losses of each portfolio also appears in the platform (in percentage and Euros terms), while information about the general ranking is included. All the process replicates on a realistic base the activity of a financial trader: everything is real except from the fact that orders are not executed. In addition to the sponsoring of Renta4, Nunsys, an important Valencian IT solutions' provider is collaborating with Florida Universitària in Brokermanía Contest.

Scores are established based on the profitability of the portfolios managed by the students (the portfolios with the highest level of profitability in the period covered by the game are awarded), which at the same time must comply with the rest of the competition rules. Once the competition is over, a prize-giving ceremony is held in the auditorium of Florida Universitària, at its Catarroja Campus, which, in addition to the prize-giving itself, includes a conference given by a leading professional in finance. This professional is responsible for analysing the national and international financial situation, closing the process of acquiring skills. Additionally, at the end of the event, the Director of University Studies of Florida congratulates students and provide the basis for the following edition of the context. Both the contest and the closing event appears in Florida's social networks and internet page, and they are covered heavily by media (Valencia Plaza and economía3 among others).

In a parallel and complementary way, Florida Universitària organises, prior to the Brokermanía Contest, another activity, called "Broker por un día" ("Broker for a day"), aimed to introduce participants (high school students and VET students in Administration & Finance from the province of Valencia) in topics related to the financial markets. Additionally, "Broker por un día" activity significantly helps to disseminate Brokermanía Contest and motivates participants to enter the competition.



Figure 1 Brokermanía's 2022 Promotional Poster and Images of the 2021 Edition.

As far as the academic field is concerned, the Brokermanía Contest is linked to a subject in the second year of the Business Administration and Management degree, *Teoría de la*

Inversió (Investment Theory). Within the syllabus of this subject, there are two units related to the profitability and risk of investment portfolios and to portfolio management and asset valuation. The game itself allows these contexts to be internalised, giving them a real dimension that they would not otherwise have. For participating in the activity, students also receive 0,5 ECTS that can be used to recognize some optional credits in the bachelor's degree programme.

In these fourteen editions of Brokermanía, between 1,000 and 1,200 contestants have participated annually. In the 2021 edition, around 950 students participated in both categories and the highest levels of portfolio returns have been well above the IBEX35 profitability, which amounts to 15,22%.

5. Concluding Remarks & Proposal of Future Research.

The Brokermanía competition has worked very well for several reasons, including the following:

- A reduction in students' subjective perception of workload.
- Decrease in the emotional burden of failure.
- Improved communication between teaching staff and students.
- Increased socialisation and the competences associated with it. viii.
- Increased teacher satisfaction.
- Personalisation of teaching.
- Saving class time on activities that students can do better outside the classroom, giving them more time for "richer" learning experiences.
- The completion of the learning process, linking practice with theory, the use of exercises, quizzes, and tests, both inside and outside the classroom.
- The incorporation of ethical discussion, at an early stage, into the curriculum.
- The increase in the level of knowledge and the improvement of qualifications.
- The increase of the playful component in the learning process.
- The use of flipped learning methodologies where the most important part of the learning is outside the classroom.
- Brokermanía Contest is also a form of blended learning, where the curriculum design includes both online and face-to-face learning.
- The use of gamification to achieve a more involved and motivated student body, which in turn dedicates more time to work and study.
- Transforming the learning process into something multiple and holistic, enabling the development of generic, professional, and transversal competences.

Given the multiple benefits associated with this methodology, the experience should be extended to other thematic content, making the use of gamification more frequent. There are many subjects in the bachelor's degree in Business Administration and Management that would qualify to enrich the learning experience through gamification, such as Finance Theory and Financial Mathematics, as well as others in the field of marketing, management accounting and strategic management.

The limitations of this paper include the fact that only the Brokermanía Contest was used to analyse the advantages of gamification. It would be interesting to study other experiences and establish parameters for comparison, to put the strengths and weaknesses of Brokermanía in perspective. Additionally, it could be interesting to frame the Brokermanía experience in the analysis of some aspects related to extrinsic and intrinsic motivations,

developing at the same time the concept of flow and how it influences the satisfaction of the participants and their desire to participate again in the competition. It would be desirable to develop a theoretical model with a central variable related to Flow Theory that could be empirically evaluated.

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GOLDEN TULIP PROJECT

Salvador Matoses Chulvi
Florida Universitària, Valencia, Catarroja
smatoses@florida-uni.es

Carles Pons Muñoz
Florida Universitària, Valencia, Catarroja
cpons@florida-uni.es

Daniel Valero García
Florida Universitària, Valencia, Catarroja
dvalero@florida-uni.es

Julio Vicente Valle García
Florida Universitària, Valencia, Catarroja
jvalle@florida-uni.es

José García Mena
Florida Universitària, Valencia, Catarroja
jgarcia@florida-uni.es

Manuel Viel Còrdova
Florida Universitària, Valencia, Catarroja
jgarcia@florida-uni.es

Abstract. The idea of the Golden Tulip (Tulipa Àuria) Project was born from the teachers of the higher-level training cycle in Industrial Mechatronics in January 2021. The purpose of this project was both to increase and improve the assimilation of competences that are highly valued by companies.

The subject Configuration of Mechatronic Systems proposes that students acquire all the specific competences and skills in order to achieve this objective. In addition to all of them, students must develop collaborative work skills in transdisciplinary environments, as is the case of companies. For this reason, it has been proposed an ambitious project that, in a synchronous and asynchronous way, involves the participation of other higher level training cycles such as Industrial Automation and Robotics, Multi-platform Applications Development and Computer Network Systems Management.

This experience will provide our students with an opportunity of working with other students who have a different training and vision of the same project. The groups of students from other higher level training cycles will participate in a collaborative way with the specific competences during the weeks dedicated to work our integrated project.

The proposed mission will be the design and construction of a manufacturing line that produces an award based on the Florida Universitària logo. This design is the first creation of the Florida Universitària Tulip logo with a design that contains the golden ratios, and its curves are made with the Fibonacci Sequence.

The project consists of an installation that generates the production process of this award; the production data is uploaded to a cybersecure space in the cloud via industrial communications and the data can also be viewed in real time from a mobile application.

Will 33 students, from different training cycles, learn to coordinate with each other in their pursuit of a common goal?

Key words: *Team Work, professional skill, challenge learning, company skills.*

1. Introduction

The main objective of this study is to collect enough information through the experience of a transdisciplinary pilot project, so that its conclusions serve as a basis for future collaborative projects. Keeping that in mind, the final result, in other words, the product they manufacture at a technical level, is not as important as the “who, when, where, why and how”. The real objective lies in the students having acquired both the specific and soft skills of the degree, so highly valued by companies nowadays.

2. Who participates in the Project.

The project is part of the educational stage of Post-compulsory Secondary education, more specifically, in Higher Vocational Training degrees. The degrees participating in this project are:

Higher Technician degree in Industrial Mechatronics, established by Royal Decree 1576/2011, November 4th,

Higher Technician degree in Automation and Industrial Robotics (hereinafter ARI), established by Royal Decree 1581/2011, November 4th,

Higher Technician Degree in Development of Multiplatform Applications (hereinafter DAM), established by Royal Decree 450/2010, April 16th.

Higher Technician Degree in Administration of Computer Network Systems (from hereinafter ASIR), established by Royal Decree 1629/2009, October 30th.

The Florida University faculty above mentioned, participated in the project as Instructional Designers, Cognitive Mediators and Instructors.

The student participation consisted in 5 students from DAM degree, 3 students from ARI degree, 5 students from ASIR degree and 20 students from Mechatronics degree.

In addition, there has also been the collaboration of José Óscar Bermejo, a student on the Master's Degree in Secondary Education Teaching, who, apart from helping to coordinate the work teams, is also carrying out a pedagogical analysis for his thesis.

3. Where did the Project take place.

The project is physically carried out in the educational centre facilities. All the resources also come from the centre, specifically from the degrees participating in the project (classrooms, laptops, Wi-Fi, software, materials...).

On the other hand, it is important to know that the Golden Tulip project in the Mechatronics training cycle and in ARI, is carried out by using a variable percentage of modules which are closer in nature to the project, according to the learning outcomes of said participating degrees. These modules were:

- **Degree in Industrial Mechatronics Professional module: Mechatronic systems configuration.** Equivalence in ECTS credits: 9. Code: 0941. Duration 140 hours. And the learning outcomes of said module can be consulted in the [RD.1576/2011](#) of this degree, Sec. I. Page 131046.
- **ARI degree Professional module: Industrial automation systems integration.** Equivalence in ECTS credits: 11. Code: 0968. Duration 160 hours.

And the learning outcomes of said module can be found in the [RD. 1581/2011](#) of this degree, Sec. I. Page 136496. The ASIR and DAM degrees dedicated two weeks exclusively to

carrying out this project. All the hours from the modules were assigned exclusively to this task at the end of the second semester. This was possible thanks to the relation this project has with the general objectives of said degrees.

General objectives of ASIR degree may be found in chapter III, article 9 in the [Real Decreto 1629/2009](#), from which this degree is derived.

General objectives of DAM degree may be found in chapter III, article 9 in the [Real Decreto 450/2010](#), from which this degree is derived.

4. Why is the Project carried out.

In general terms, the motivation for this project emerges from the will of the participating teachers to bring students closer to a typical professional project environment, in which they will soon be involved. This way, they will be able to get to know themselves better by facing real situations of cooperative work in transdisciplinary groups, as occurs in real companies. Furthermore, each degree in particular has specific motivations of their own, this motivations are:

4.1 Specific DAM motivations:

In the Multiplatform Applications development degree, the work process that takes place in a developing company is simulated every year.

The team in charge of the Golden Tulip Project had the handicap of not having decided the nature of the project by themselves, but rather having a client, in this particular case students from the Mechatronics degree, who indicated them which variables they had to monitor. On the other hand, students from ASIR degree, provided us with the platform which collected the data from the automatons and allowed us to read it. All this combined, gave the students a special motivation.

4.2 Specific ARI motivations:

The chance of working in a professional environment, even if it is simulated, is a perfect opportunity for vocational training students to acquire a series of necessary skills in a real work environment.

Apart from the concepts and procedures that are taught in the cycle, there are other skills that companies demand and, although some of them are developed within the different modules, others are only acquired by simulating a real work environment.

The students of the Automation and Industrial Robotics cycle must be able to coordinate with different departments of the company, both with the operation technologies department (OT) and with colleagues belonging to the world of information technologies (IT).

Industrial future demands that IT and OT professionals work together and in a coordinated manner, since digitalization is already part of the productive fabric, where cyber-physical systems require the joint work of both profiles.

4.3 Specific ASIR motivations:

For the ASIR cycle, the Integrated Project involves the creation of the most real infrastructure possible, therefore, the requirement asked for each year, is to have a fully functional system that is as close as possible to a professional one.

The possibility of participating in this transdisciplinary project allowed us to establish this vision of integration even further, making our students require the interaction with other departments. This way, the students had to provide a service which the rest of the students of other degrees didn't necessarily have the knowledge for.

4.4 Specific Mechatronics motivations:

The faculty from this degree feels highly involved in simulating an industrial and company like environment. With this experience, we believe students will come closer to the multidisciplinary environments which are the usual circumstance in today's labour world.

5. When does the Project take place.

Timing was different on each degree, the main reason being the need to work previously on the necessary competences before being able to apply them to the project, and the particular schedule each degree was bound to.

This way, the timing in each of the degrees was as follows:

5.1 DAM degree:

The process takes place in its entirety during the second assessment period of the course. As the Integrated Project of 2nd course in DAM schedule dictates, on 01/07/22 students had to deliver a prototype of the app, and between 01/31/22 and 02/15/2022, they developed all the code, with the required testing.

5.2 ARI degree:

The development took place from September 2021 to February 2022.

5.3 ASIR degree:

Work on the Project took place throughout the first two assessment periods in the second course.

The first phases of the project, which consisted in generating documentation and designing the infrastructure, took place during the first assessment period.

During the second assessment period, the necessary systems were implemented.

Finally, the two last weeks of the course were spent in debugging problems that erupted during the implementation and wrapping up the required documentation.

5.4 Mechatronics degree:

Project development took place during the first two assessment periods on the second course of said degree. First phase of the Project, consisted in the design and preliminary study of the possible solutions in order to fulfil the necessity at hand (from Sep 21th, to October 21th). Once the preliminary design was completed, they materialized it from October to February.

6. What is done in the Project.

The Florida University logo was born from a study carried out by the Valencian designer Juan Martínez, who was in charge of renewing and graphically unifying the corporate identity of

Florida Grup Educatiu in 2017. The design combines the coat of arms of King James the first with the orange blossom, symbolizing the person who ‘flourishes’ through education.

From this 2D design of the corporate image, the creation of a 3D award is proposed, to reward or recognize merits with. The proposed design uses the Fibonacci series on the curves and the Golden Number in its proportions in order to take advantage of the mystery that surrounds these elements in nature.



Figure 1: Logo design 2D.



Figure 2: Logo design 3D

7. How is the Project developed.

7.1 ARI:

As far as the ARI cycle is concerned, the development process was to collect the data which had to be monitored in the APP.

Production processes tend to become data (cyber-physical systems) to be managed/analysed in order to allow substantial improvements in the manufacturing processes. This implies that ARI students needed to coordinate with another OT department (Mechatronics cycle) to process the capture of data, and with the IT department (ASIR cycle) to upload said data to the cloud.

Data acquisition involves the collection of information from the machine through industrial networks, in this case ProfiNet. The link between the manufacturing process and the data cloud is a Siemens IoT2040 equipment, that is responsible for transferring the information to the cloud using the MQTT encrypted communication protocol.

The module configuration requires programming by blocks using the Node-Red web environment. Data to be collected is programmed in it, and the communication with the server in which this data is to be written, is adjusted.

Finally, the IoT equipment is physically connected to the automaton that manages the machine, with an internet access that will allow the flow of information.

7.2 ASIR:

In the case of ASIR, integration in the production chain consisted in the setting up of a computer service called MQTT. This service allows the interconnection of the IOT devices used in the ARI cycle, with the final application that will show the telemetry data to the end user, coded by the DAM cycle.

It is a fully transparent service, since there is no interaction of any kind with users but instead serves as a support for the communication between the systems. At the same time, it is essential for being able to take the data from the production chain to the databases located on cloud platforms.

7.3 DAM:

From the DAM cycle, during the first fortnight of January, the prototype that was provided was reviewed by the students and the teacher.

After correcting a few things, they arranged a virtual meeting with mechatronics students, in order to show them the prototype created thus far.

After collecting feedback from the mechatronics team, the phase of development of the graphical interface began by some members of the team. At the same time, other team members were researching how to install and work with brocker 504aniela504 and MQTT.

Once a testing environment is installed locally, the members tried different third parties to work with 504aniela504 from the react-native framework, finally choosing the 'sp-react-native mqtt' library.

The second phase of the project consisted of connecting the development of the screens with the brocker 504aniela504, using the aforementioned app.

Finally, when they had the real environment in their hands, provided by their ASIR partners, they modified the app code for it to point to the real environment, instead of the local one, as they had been previously testing.

Once connected, they carried out the tests they considered necessary to make sure that it worked correctly.

7.4 Mechatronics:

The Mechatronics degree aimed to design and build an assembly line that manufactured the trophy automatically. Said assembly line counted with the communication and automation systems required, so that ARI could access to the productive data and thus allow remote connection to the process information.

8. Conclusions.

8.1 ARI:

Student learning has been highly valued, both by the students themselves and by the cycle teachers. Innovation and creativity have been further developed, using state-of-the-art equipment in the sector, together with a communication protocol that is becoming more and more established in 4.0 Industry communications. Other skills worked on were: intra-disciplinary and transdisciplinary teamwork, lifelong learning, problem solving, written and oral communication, digital competence (ICT) or leadership, amongst others.

The biggest challenge has been the coordination with the rest of the work teams. The meetings have allowed the sharing and discussion of the project progress, although it was difficult due to availabilities, more so working between training cycles with different school hours (morning and afternoon). Even so, there has always been at least some team member that has been able to attend.

8.2 DAM:

As a team, students have found the project interesting, although at first, they did not show much interest. Not all team members have been 100% involved, but those who have, have given their best. They have succeeded in overcoming difficulties as they have appeared, and they have spoken among themselves and organized themselves quite well.

The work amongst cycles was the weakest part of the project, since coordination was difficult. General meetings are necessary, but results obtained from each cycle must fit the schedule better.

In the end, the product created has been interesting for them, as well as the process.

8.3 ASIR:

At the beginning of the project, ASIR students also found very interesting the possibility of developing a project with other degrees that would allow them to interact with other specialities without a direct relationship with what they were studying. Nevertheless, in the end I think they could have communicated better with the rest of the degrees, to correctly refine the needs and fully exploit the possibilities offered by the service.

As per usual in our field, we did not have a visible part or a final product that could be assessed. This lack of visibility is key for the work of a system administration specialist, with the objective that everything works normally. Therefore, I consider that the objective was completed satisfactorily, since it was possible to establish communication, in addition to the creation of an infrastructure with a strong security that ensured the continuity of the service, according to the standards learned during the course.

8.4 Mechatronics:

The creation of a single project in which all the members of the several degrees participated in, has been very complex and has gone through several emotional phases, both among the students and the teachers. In short, all the members expressed a good opinion about what they learned and their collaborative work towards meeting the deadline.

In the end, due to delays in the accomplishment of a final design for the proposal, a delay in the reception of materials was experienced. Also having to add the troubles caused by the periodical absence of many of the members due to COVID-19, the project could not be 100% automated at the end.



Figure 3: Machine view 1



Figure 4: Machine view 2



Figure 5: Several trophies completed

All the stations worked fine independently, but not in a synchronous manner so that trophies could be generated automatically. We estimate that it would have taken two more weeks of classes for it to be fully automated.

Anyway, this did not cause a failure in delivering the order required by Florida University marketing department, as the trophies could be manufactured and delivered on time for the awards ceremony.

Students learnt that they must satisfy their client needs above all, and this is one of the best learnings they have acquired during this promotion [1].

In addition, we can see the comments of the students in the following links:

Conclusions: [2],[3],[4],[5],[6], [7] and [8].

We can also visualize the data surveyed, in order to identify the level of satisfaction of the students in the different degrees according to the following survey [9].

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MOTIVATION AND FOREIGN LANGUAGE ANXIETY OF CROATIAN LEARNERS

Sandra Didović Baranac

University of Dubrovnik, Dubrovnik, Croatia
sandra.didovic-baranac@unidu.hr

Daniela Falkoni-Mjehović

University of Dubrovnik, Dubrovnik, Croatia
daniela.falkoni-mjehovic@unidu.hr

Anja Vlahov

Dubrovnik Gymnasium, Dubrovnik, Croatia
anja.vlahov@gmail.com

Abstract. This paper aims to provide an insight into motivation and foreign language anxiety of Croatian high-school learners of English, German and Spanish as foreign languages in a formal Croatian educational context. Two research instruments were applied in the study. The first instrument was a questionnaire used to collect data on participants' attitudes/motivation for foreign language learning. This instrument was developed in Hungary and validated in Croatia in 2007. The second instrument was Croatian English as a Foreign Language Anxiety Scale, which was used in Croatia in 2004. The questionnaires were adapted for this study in order to investigate the motivation for learning English/German/Spanish and English/German/Spanish anxiety. The results point to significantly higher levels of motivation for learning English than for learning German and Spanish, and significantly lower English anxiety compared to German and Spanish anxiety. Results of the study suggest that motivation for learning Spanish and German decreases over time. A statistically significant negative correlation between motivation and anxiety was established in all groups. The findings of this comparative study will enable foreign language teachers to gain an insight into the importance of motivation and foreign language anxiety as important individual factors in foreign language learning and may have important practical implications in the Croatian socio-educational context.

Key words: *motivation, anxiety, English, German, Spanish*

1. Introduction

Research in the field of second language acquisition and foreign language teaching has shown the importance of the role of affective factors, which, in addition to cognitive factors, are investigated within a special research subfield called individual differences. In the socio-educational model of second language acquisition (Gardner & MacIntyre, 1993), individual differences include cognitive variables (intelligence, language aptitude, and language-learning strategies) and affective variables (language attitudes and motivation, and language anxiety). All elements of the socio-educational model operate within a particular socio-cultural context which directly or indirectly affects exposure to a second language, the status of second language in the community in which a student learns the language and the student's perception of the importance of knowing that language (Mihaljević Djigunović, 1998: 12).

2. Motivation and anxiety as individual variables in foreign language learning

Motivation to learn a foreign language (FL) has been researched for a long time, and according to Dörnyei (2005) the first period of the development of motivation theory was the social psychological period lasting from 1959 to 1990. During that time, first research into attitudes and motivation for second language acquisition was conducted and a second language acquisition model was being developed (Gardner & Lambert, 1972; Gardner & MacIntyre 1992, 1993). Gardner (1985) defined motivation as a combination of effort, desire to achieve a goal in language learning and favourable attitudes towards language learning and warned of the negative impact of foreign language anxiety (FLA) in the language-learning process. In order to measure attitudes/motivation and other attributes associated with second language learning The Attitude/Motivation Test Battery (AMTB) was developed (Gardner, 1985). The period of the 1990s was the cognitive-situated period. A micro-perspective was applied in research, and Dörnyei (1994) proposed a tripartite L2 motivation construct which comprises integrative motivation, self-confidence, and the appraisal of the teaching environment. The end of the 1990s brought the dynamic perspective which was characterized by dynamic systems and contextual interactions. In the third period, the process-oriented period, it was examined how motivation changes during the language-learning process, and how it can differ before the beginning of learning, during learning and after completing a certain period of learning (Dörnyei & Otto, 1998; Medved Krajnović, 2010). After the year 2000 different conceptualizations of motivation have taken a particular account of the specifics of the contemporary globalized world and the status of English as a world language, emphasizing the impact of social and geopolitical context on attitudes and motivation for FL learning. Dörnyei (2005) proposed a new motivational construct, the L2 Motivational Self-System, which consists of three components: ideal L2 self, ought-to L2 self and L2 learning experience. Recent research on motivation among students studying multiple languages has led to the conceptualization of a multilingual motivational self-system (Henry, 2017; Ushioda, 2017).

Theoretical considerations of foreign language anxiety (FLA) as a separate phenomenon in FL learning can be found in Horwitz, Horwitz and Cope (1986), who constructed the Foreign Language Classroom Anxiety Scale (FLCAS), the most commonly used questionnaire in FLA research. According to Horwitz et al. (1986) FLA is defined as “a distinct complex of self-perceptions, beliefs, feelings, and behaviors related to classroom language learning arising from the uniqueness of the language learning process”, and it is primarily responsible for any (or at least most) negative effects on second language learning and achievement (Horwitz et al., 1986; Horwitz, 2017). Conceptual foundations of FLA are communication apprehension, test anxiety and fear of negative evaluation. Over the past four decades, we have come across different approaches to understanding the FLA. According to MacIntyre and Gardner (1989) FLA is a consequence of repeated negative experiences during FL learning, which make the learner associate the feeling of anxiety with FL itself. In the socio-educational model (Gardner & MacIntyre, 1993) FLA is defined as FL class anxiety and FL use anxiety. FLA has been shown to differ according to different socio-cultural backgrounds and the language being learned. Thus, further models have been developed in line with these findings, such as the Model of Second Language Learning by Gardner et al. (1997) and the Structural Equation Model by Yamashiro and McLaughlin (2000). Regardless of socio-cultural and socio-educational specifics, in a large number of studies negative correlation between motivation

and anxiety has been found (Gardner et al., 1992; Csizér & Dörnyei, 2005; Wei, 2007, Papi, 2010; Liu & Huang, 2011; Liu & Zhang, 2013).

In Croatia, most research into attitudes, motivation and FLA has been conducted by Mihaljević Djigunović, but two studies stand out for which new questionnaires were constructed. Both questionnaires are specific to the Croatian socio-educational context. To research into motivation, the Types and Intensity of Motivation for Learning EFL Questionnaire was constructed (Mihaljević Djigunović, 1998), and to research into anxiety, the Croatian English as a Foreign Language Anxiety Scale – CROEFLA (Mihaljević Djigunović et al., 2004) was used. In her research, the author has pointed out the negative correlation between motivation and FLA and has given impetus to further research of these important affective factors.

Research in the field of foreign language acquisition, conducted over the last 20 years has shown that English is perceived more as a second language than as a foreign language (Phillipson, 2008), that it is more popular than other foreign languages (Csizér & Dörnyei, 2005; Csizér & Lukács, 2010) and that it can have an adverse impact on motivation to learn other foreign languages (Phillipson, 2008; Busse, 2017). The growing importance of the English language in Europe is influenced by ongoing globalization processes. There is a “competition” among target languages for learners' limited language-learning capacity, and in this competition the World English seems to have won the race (Csizér & Dörnyei, 2005: 657). Because of the status of English, the dynamics of the motivation to learn Global English might be very different from the motivation of learning languages other than English - LOTES (Dörnyei & Al-Hoorie, 2017). Research on individual factors in learning LOTES focuses on the role of socio-cultural context in which English and LOTES are taught.

3. Methodology

3.1 Aim

The aim of the study was to determine the level of motivation and anxiety in foreign language acquisition among Croatian high-school learners learning English, German and Spanish in a formal Croatian educational context, to determine whether there are differences in motivation and anxiety with reference to the target language and to examine the relationship between motivation and anxiety.

The following hypotheses were defined:

H1: There are differences in the motivation to learn English, German and Spanish. The level of motivation varies according to the target language.

H2: There are differences in English, German and Spanish language anxiety. The level of anxiety varies according to the target language.

H3: Motivation for language learning and FLA are negatively correlated. A negative correlation exists between FLA and FL motivation for all groups.

3.2 Sample

370 participants, learners of the Dubrovnik Gymnasium, took part in the research. Each learner participated in the research for only one language, English, German or Spanish. The breakdown of the language groups with reference to gender is shown in Table 1 below.

Table 1 Breakdown of the sample - gender

Language	Gender		Total
	female	male	
English	92 (71.3%)	37 (28.7%)	129
German	61 (51.7%)	57 (48.3%)	118
Spanish	77 (62.6%)	46 (37.4%)	123

The breakdown of the language groups with reference to grade is presented in Table 2 below.

Table 2 Breakdown of the sample – language and grade

Language	Grade				Total
	1st	2nd	3rd	4th	
English	30 (23.3%)	36 (27.9%)	32 (24.8%)	31 (24%)	129
German	19 (16.1%)	29 (24.6%)	31 (26.3%)	39 (33.1%)	118
Spanish	32 (26%)	30 (24.4%)	33 (26.8%)	28 (22.8%)	123

3.3 Instruments and procedure

Several instruments were used in this research: the attitude/motivation questionnaire for learning English, German and Spanish, the anxiety questionnaire for English, German and Spanish and the background questionnaire which aimed to gather participants' demographic data such as L1, gender, age, last final grade (English, German and Spanish) and length of FL learning. The Attitude/Motivation Scale for English/German was used in the research conducted by Mihaljević Djigunović and Bagarić in 2007. It comprises 14 statements examining attitudes/motivation for learning English/German. The questionnaire was constructed and used in Hungary and validated in Croatia. For the purposes of our research, the questionnaire was adapted to examine attitudes/motivations for learning Spanish by substituting the words English and German by the word Spanish. The adaptation resulted in three versions of the same questionnaire. The second questionnaire used in our study is the CROEFLA (Mihaljević Djigunović et al., 2004). Since FLA is a culturally and socially conditioned phenomenon, Mihaljević Djigunović and her associates developed an instrument for FLA adapted to the cultural and social context of FL learning in Croatia. The questionnaire consists of 24 statements and examines the level of the participants' discomfort in class and the anxiety related to communicating inside and outside the classroom in the Croatian social context. For the purposes of our comparative study, the CROEFLA was adapted by replacing the word English with the words German and Spanish, respectively, and three versions of the same questionnaire were obtained. The participants had to assess on five-point Likert-type scale (1-it does not apply to me at all, 5-it applies to me completely) how well each of the statements described them. The research was conducted during regular classes in February 2021. It took 15 minutes to complete the questionnaires. Learners participated in the research voluntarily and were guaranteed anonymity and confidentiality of collected data.

4. Results and discussion

4.1 Descriptive statistics

First, the Cronbach alpha (α) was calculated for both questionnaires, and high reliability was established for both instruments for all three groups, i.e., for all three examined languages. The reliability of the motivation questionnaire was $\alpha=0.853$ for English, $\alpha=0.874$ for German, and $\alpha=0.892$ for Spanish. The reliability of the anxiety questionnaire was $\alpha=0.972$ for English, $\alpha=0.954$ for German, and $\alpha=0.962$ for Spanish. Then, a quantitative analysis was performed on the data collected by the motivation questionnaire and the anxiety questionnaire. Table 3 shows the results of descriptive statistics for motivation for three groups.

Table 3 Descriptive statistics – motivation

English (N=129)			German (N=118)			Spanish (N=123)		
M	SD	Range	M	SD	Range	M	SD	Range
4.16	0.61	2.14-5.00	3.22	0.79	1.00-4.64	3.68	0.78	1.21-5.00

The results show a high level of motivation for learning English, and a medium level of motivation for German. Motivation for learning Spanish is lower than motivation for English and higher than motivation for German. For English, learners are found to be most motivated by their interest in English-language films and music (item 5 M=4.71, SD=0.67), their parents' attitude that English is important (item 3 M=4.59, SD=0.71) and learners' own attitude that English is an easy language to learn (item 8 M=4.45, SD=0.92). In the German learning group, the highest degree of agreement is recorded for item 9 (M=3.75, SD=1.29) which expresses the belief that more effort is needed to learn German successfully, item 3 (M=3.51, SD=1.32), the parents' attitude that German is important and item 1 (M=3.22, SD=1.33) by which the participants express that they like German. The highest level of agreement for motivation to learn Spanish is found in item 1 (M=4.22, SD=1.01) which shows that learners like Spanish, in item 5 (M=3.77, SD=1.27) by which they express their interest in films and music in Spanish and in item 4 (M=3.74, SD=1.25) which refers to their interest in people who speak Spanish. The learners agree at a low level with item 2 "Knowing English/German/Spanish is useless to me." in all three language groups (English M=1.15, SD=0.60, German M=1.87, SD=1.14, Spanish M=1.67, SD=1.04). This result indicates that our participants recognize that knowing English/German/Spanish is useful.

The results of descriptive statistics for anxiety for three groups are shown in Table 4.

Table 4 Descriptive statistics – anxiety

English (N=129)			German (N=118)			Spanish (N=123)		
M	SD	Range	M	SD	Range	M	SD	Range
1.75	0.89	1.00-4.96	2.53	0.95	1.00-4.67	2.38	0.97	1.00-4.79

Results indicate that our participants experience low to moderate levels of anxiety for all three languages. By comparing results in Table 4 we notice that learners experience low anxiety for English, and higher anxiety for German than for English. The results for Spanish show lower anxiety than for German, and higher than for English. Our findings are in line with the

findings of two comparative studies in which the CROEFLA was used, and which indicated low anxiety in relation to Italian, Portuguese, and English (Klak & Svilarić, 2015; Svilarić et al., 2015).

For English, participants expressed the highest degree of agreement with the item 18 (M=2.22, SD=1.37), item 2 (M=2.15, SD=1.46) and item 5 (M=2.10, SD=1.34). Item 18 and item 2 refer to the discomfort and anxiety a person feels when speaking in a formal learning environment. Item 5 describes the fear of making mistakes in language use caused by insecurity. For the German language, participants expressed the highest degree of agreement with item 16 (M=3.36, SD=1.46), item 5 (M=3.10, SD=1.4) and item 11 (M=3.08, SD=1.31). While item 16 addresses the anxiety related to communication outside of classroom due to insufficient language proficiency, item 5 describes the fear of making mistakes in language use. Item 11 refers to the uncertainty arising from the belief that German grammar is complicated. For Spanish, participants expressed the highest level of agreement with item 9 (M=2.95, SD=1.4), item 16 (M=2.93, SD=1.47) and item 5 (M=2.86, SD=1.36). Item 9 refers to the anxiety associated with longer communication in Spanish, and item 16 the anxiety a person feels when communicating in Spanish outside of classroom. Item 5 describes the fear of making mistakes. We can conclude that learners express the fear of making mistakes in the use of language for all three examined languages. The fear of making mistakes is also thought to be associated with the fear of negative evaluation. Many studies have shown that participants believe that the use of a foreign language requires accuracy, and that this is one of the main sources of FLA (Horwitz et al., 1986; Mihaljević Djigunović, 2002; Kostić Bobanović, 2009). Among the items with the lowest degree of agreement, item 14 which expresses an assessment of the difficulty of the language stands out for English (M=1.32, SD=0.74) and Spanish (M=1.70, SD=1.04). Our learners do not consider English and Spanish to be difficult languages which could be related to low anxiety. Low level of agreement is obtained for item 15 for all three languages (English M=1.48, SD=0.89, German M=2.08, SD=1.3, Spanish M=1.81, SD=1.11). Our participants express that they are not embarrassed to ask for help if they do not understand something, which indicates an active attitude towards resolving ambiguities in FL learning.

4.2 Difference between groups with reference to the length of FL learning

Given the specifics of the Croatian socio-educational context in which English is most often learned from the first grade of primary school, and German and Spanish begin to be learned later, a comparison between groups was made with respect to the length of FL learning, i.e., years of FL learning. The analysis of variance shows that there is a statistically significant difference between groups ($F=654.59$; $df=2.367$; $p<0.001$), and that the difference in the length of FL learning is statistically significant between all groups (Table 5).

Table 5 Comparison of groups with reference to the length of FL learning (years of FL learning)

English (E) (N=129)			German (G) (N=118)			Spanish (S) (N=123)			F
M	SD	Range	M	SD	Range	M	SD	Range	
10.74	1.43	2-14	6.45	2.32	1-11	2.77	1.38	1-8	654.59*** E>G*** G>S*** E>S***

*** $p<0.001$

Learners have been studying English for the longest time, an average of ten years, then German, an average of six years and the shortest learning period is for Spanish, an average of two years. Thus, there is a statistically significant difference between groups with reference to the length of FL learning.

4.3 Relationship between the length of language learning and motivation and differences in motivation with reference to language

In the English language group, the length of language learning doesn't correlate with-foreign language learning motivation ($r=0.08$, $p>0.05$). However, in the group learning German a statistically significant negative correlation was found between the length of learning German and motivation to learn German ($r=-0.27$, $p<0.01$), i.e., those who learn German longer have lower level of motivation. In the group learning Spanish, a statistically significant negative correlation was also found between the length of learning Spanish and motivation to learn Spanish, i.e., there is a statistically significant correlation between a longer period of learning Spanish and lower level of motivation ($r=-0.19$, $p<0.001$). To determine differences in motivation to learn English, German and Spanish, an analysis of covariance was conducted. Given that in the group of German and Spanish a statistically significant negative correlation was found between the length of language learning and motivation to learn a foreign language, the length of language learning was included in the analysis as a covariate. The obtained F ratio of the applied analysis is statistically significant ($F=50.92$; $p<0.001$, partial $\eta^2=0.218$). Table 6 shows the results for group comparison.

Table 6 Comparison of groups with reference to learning motivation

English (N=129)			German (N=118)			Spanish (N=123)			F
M	SD	Range	M	SD	Range	M	SD	Range	
4.16	0.61	2.14-5	3.22	0.79	1-4.64	3.68	0.78	1.21-5	F=50.92*** E>G*** E>S***

*** $p<0.001$

The group learning English has a statistically significant higher motivation than the group learning German ($p<0.001$), as well as the group learning Spanish ($p<0.001$), while the difference in motivation to learn a foreign language is not statistically significant for groups learning German and Spanish, respectively ($p>0.05$). The results have confirmed H1. Findings of many studies have shown that motivation changes over a longer period of language learning and that there is a tendency for motivation to decline (Gardner et al., 2004; Lamb, 2007; Williams et al., 2002). According to Dörnyei and Ushioda (2011), as the initial interest in language learning declines, so does the motivation, which may be associated with increased cognitive, linguistic, and curricular demands and social pressures. Research into attitudes/motivation for English and for LOTE has shown differences with reference to language. According to Mihaljević Djigunović and Bagarić (2007) the motivation to learn German in Croatia decreases between two age points of the learners' language and affective development: end of primary education (age 14) and end of secondary education (age 18) while the motivation for English does not decrease. Edlert and Bergseth (2003) point out that learners in Sweden start learning Spanish later than English, and since it is a new and unknown language, learners feel that the material is complicated and that it takes a lot of energy to reach a level which enables them to communicate fluently. Therefore, after the

initial period, there is a decrease in motivation. The authors conclude that the motivation for English does not decrease because it is learned from an early age and during secondary education language skills are improved. Lightbown and Spada (1999) mention that learners who have one to two hours of FL a week often become frustrated because they do not progress as much as they would like. Therefore, we could conclude that our participants also have a lower level of motivation to learn German and Spanish because they start learning these languages later than English, don't have as many classes per week as English classes and progress relatively slowly. Learners encounter completely new language content that they need to master, their initial enthusiasm weakens, and their motivation decreases.

The results of our research show that the motivation to learn English is higher than the motivation to learn German and Spanish. The reason could be the specific status of the English language in Croatia. English is the first foreign language, it is taught most often from the first grade of primary school, and learners' language proficiency in English is expected to improve during secondary education. English is the language of international communication, therefore, our learners are very much exposed to it outside of classroom (movies, music, social networks, the Internet), and experience its usefulness on a daily basis. Because of the dominant *lingua franca* function of English, learners who learn English worldwide need to be able to communicate with a diverse group of users who use English as a FL rather than with the group of native speakers (Csizér & Illés, 2020).

All these reasons could explain high motivation for learning English. The motivation to learn German and Spanish is lower than the motivation to learn English, but no statistically significant difference in motivation levels was found between German and Spanish. German and Spanish do not have the status of languages for international communication, and they are second foreign languages taught during shorter period than English. All the reasons mentioned above may cause decrease of motivation. In addition, extracurricular exposure to German and Spanish is rare, which may be associated with lower level of motivation. Our results are comparable to studies in Europe that have shown that the motivation to learn English is higher than the motivation to learn LOTE (Csizér & Lukács, 2010; Busse, 2017).

4.4 Relationship between the length of FL learning and anxiety

In the group learning English, the correlation between the length of language learning and anxiety was on the verge of being statistically significant ($r=-0.17$, $p=0.05$). In the group learning German, the correlation of the length of learning and anxiety was not statistically significant ($r=0.15$; $p>0.05$), nor was that the case in the group learning Spanish ($r=0.08$; $p>0.05$). The results of our research are in line with the results of a comparative study conducted by Puškar (2010) in which he found that university students of English and German studies showed no difference in anxiety with respect to longer or shorter language exposure except for one result indicating lower German language anxiety for those students who spent a longer period of time in a German-speaking country.

4.5 Differences in anxiety with reference to language

To determine if there were differences in anxiety related to English, German, and Spanish, an analysis of variance was conducted. The F ratio of the performed analysis is statistically significant ($F=24.70$; $p<0.001$, partial $\eta^2=0.119$). Table 7 shows the results for group comparison.

Table 7 Group comparison with reference to foreign language anxiety

English (N=129)			German (N=118)			Spanish (N=123)			
M	SD	Range	M	SD	Range	M	SD	Range	F
1.75	0.89	1-4.96	2.53	0.95	1-4.67	2.38	0.97	1-4.79	F=24.70*** E>G*** E>S***

***p<0.001

The group learning English has a statistically significant lower anxiety than the group learning German ($p<0.001$), as well as the group learning Spanish ($p<0.001$), while the difference in FLA is not statistically significant for groups learning German and Spanish, respectively ($p>0.05$). The results have confirmed H2.

Different levels of FLA were identified in a comparative study conducted by Piniel (2006) in Hungary, and in comparative studies conducted by Puškar (2010) and by Mardešić and Stanković (2013) in Croatia. Given that our research findings show that the languages examined do not differ in anxiety with reference to the length of learning, the differences in anxiety with reference to the language being learned could first be explained by the specific status of each language, English as a world language, and German and Spanish as foreign languages. Global English has maintained its high educational profile and its status of *lingua franca*. Thus, learning languages other than Global English is impeded by the 'Englishisation' process (Dörnyei et al., 2006), which may be related to the difference in the levels of anxiety between English and other languages, such as German and Spanish in our research. It is possible that a larger exposure to English outside of classroom also contributes to a lower level of English anxiety compared to higher level of German and Spanish anxiety.

4.6 Relationship between foreign language anxiety and motivation to learn a foreign language

In the English language group, anxiety was negatively correlated with motivation ($r=-0.82$; $p<0.001$). A negative correlation was also found in the group learning German ($r=-0.68$; $p<0.001$), as well as in the group learning Spanish ($r=-0.76$; $p<0.001$). All correlations are statistically significant. The results have confirmed H3. Our result of negative correlation between motivation and anxiety for all three examined languages is consistent with the findings of many studies that indicated a negative correlation between these affective factors (Mihaljević Djigunović, 2000, 2002; Hashimoto, 2002; Gardner et al., 2004; Liu & Huang, 2011; Khodadady & Khajavy, 2013; Dewaele & Proietti Ergün, 2020). Since learners with higher motivation experience lower levels of anxiety we could conclude that strengthening motivation could reduce FLA.

5. Conclusion

The results of our research show that the motivation to learn English is higher than the motivation to learn German and Spanish, and that, unlike English, the motivation to learn German and Spanish decreases with the length of FL learning. The main reason for the lower level of motivation and decline of motivation for German and Spanish could be the status of German and Spanish, which are taught during a shorter learning period than English and have the status of a second foreign language in Croatia. Being the first foreign language and *lingua franca*, English has a specific status. It is taught for many years and learners are

exposed to English on a daily basis outside of classroom. The level of anxiety was found to be lower for English than for German and Spanish. The status of the Global English could also be one of the main reasons why English anxiety is lower. The study has confirmed a negative correlation between two important affective variables – motivation and anxiety – which indicates their interaction. Although our study does not explain the full complexity of learners' FL motivation and FL anxiety, the present findings may serve as a springboard for future comparative studies. In the future, quantitative and qualitative methods should be used to examine motivation and anxiety, as well as the role of other individual learner variables and their interactions in the learning context.

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USE OF ICT TOOLS IN ERASMUS+ PROJECTS INSIDE COMUNITAT VALENCIANA: TEACHER'S PERSPECTIVE

Rosario López Contreras
Florida Secundària. València, Spain
chlopez@florida-uni.es

Abstract. The present study investigates the use of ICT technologies in the field of collaborative learning through multicultural exchanges, more concretely inside Erasmus+ projects, where the use of digital technologies has become essential when designing, developing, and implementing work routines. The investigation also tries to establish the training necessities of both teachers and students involved in the projects, since the concept of *digital gap* has become a major issue concerning the participation in these activities. Digital tools can democratise the participation in multicultural activities regardless of the socioeconomic environment of the participants and they can be helpful when adapting the learning process to everyone; therefore, knowing the strengths and weaknesses detected becomes an important item to consider.

To measure the impact of ICT tools in Erasmus+ projects and the needs detected on teachers and students, a questionnaire was filled by 38 participants from 21 schools around the territory of the Comunitat Valenciana which participated in Erasmus+ actions in the last years. The questionnaire was composed by 3 blocks of questions: the first one aimed at teachers, the second one focused on the necessities perceived by teachers on the students participating in multicultural actions, and the last one aimed at knowing the impact of the COVID-19 pandemic in the implementation of the projects. The main findings reveal that training in the use of ICT tools constitutes a weakness and a principal necessity; consequently, they need to be considered when trying to implement this kind of activities. In relation to teachers, it is perceived a digital gap, so choosing the appropriate tool in the different phases of the project becomes crucial. Regarding students, the investigation shows that the concept of digital native doesn't imply that they have complex technological abilities; they also need training. Finally, it is concluded that the use of ICT tools does help to personalise and democratise learning.

Keywords: ICT, Erasmus+ projects, telecollaboration, cooperative learning.

1. Introduction

Collaborative learning and ICT are closely related. For decades, the educative community has been trying to find tools to increase the flexibility of the learning process, thus placing the student at the centre of the teaching action, constantly recycling their role as catalyst, both inside and outside the classroom. Digital tools become a good option to get closer to our students' centres of interest and, at the same time, adapt our lessons to the different learning paths of each person. Technology can facilitate to plan and manage the educational resources that teachers have, optimising their time and the communication between school and families.

Teaching and learning through these tools gained more relevance and importance since the outbreak of the COVID-19 pandemic, when all the community had to adapt suddenly to a new methodology totally dependent of the new technologies. The concept of *digital gap* has been widely used during this period. The gap actually exists, and it does not refer only to students, who may have socioeconomic difficulties in accessing an internet connexion or a computer, but also to members of the teaching teams, who have not had the possibility (or

the motivation) to be up-to-date about online learning methodologies. It is mandatory that the teaching teams feel confident and competent when they manage the different instruments to get the most of them and transmit their students, in an efficient way, the same competences that they need to acquire.

Focusing a little more, inside multicultural projects, the use of digital tools become essential when designing, developing, and implementing working routines. In an environment in which partners from different countries take part in the same task, online communication is fundamental. However, the sanitary situation in 2020 slowed down (and in some cases paralysed) part of these multicultural projects, and to reactivate them it was necessary to implement a great number of digital interventions that adapted them to that new context. Regarding the teachers taking part in these activities, the greatest change was transforming the managing meetings into online ones. As for students, as it was not possible to participate in exchanges, schools opted for keeping the contact among partners in a virtual way, using all kinds of applications and technological tools. This way they lost the real immersive experience that exchanges offer, but at least it was possible to keep the linguistic exchange. In our investigation, we intend to analyse and demonstrate some premises related to the use of Information and Communication Technologies inside education, focusing on Erasmus+ intercultural projects: Key Action 1 (KA1 – fostering teacher mobility for learning objectives) and Key Action 2 (KA2 – fostering teacher and student mobility). In detail, we will focus on the following ideas:

- The use of ICT tools in telecollaborative projects speeds up the process of creation of material and contacts among the different participants, who take advantage of these tools to share ideas and methodology, and to create the activities and tasks that will be implemented during the project. Digital technologies allow, as well, to expand the network of the schools and paperwork (reports, descriptive memories, etc). ICT tools also help in the process of evaluation of the project, starting with the official institutions, which provide a series of applications in which we need to record all data and reports about the results of the activity.
- The fact of being “digital born” (i.e. to have been born in a context in which technology was already part of our day-to-day) does not turn our students into experts in the matter. Alternatively, they require specific training prior to the use of a new tool with the objective of making sure that they get the necessary skills to get an optimal output. The wide variety in platforms, applications and digital instruments that are at hand sometimes result in an obstacle rather than a learning opportunity. Therefore, it is essential to have some training in digital competence that helps to choose the most suitable tool for every task. Since the teachers are the direct responsible for this competence, teacher training in ICT tools becomes essential.
- Digital tools can “democratise” participation in multicultural activities, promoting that all kind of students take part in them, regardless of their socioeconomic context. Even though these activities are mostly funded, some families are still reluctant to send their children abroad for different reasons. However, this reluctance can be reduced if participation in the exchange is limited to a virtual environment. Likewise, students may be eager to participate in these activities without getting out from their comfort zone and their social context.
- ICT tools can help improving the basic skills of our students and, extensively, the quality of the school’s educative project, improving the international dimension of the school activities. Competence development is a key objective of all the educative institutions, and

dissemination of the multicultural activities can be added value to the community that takes part in them.

- Regarding the situation caused by the COVID-19 pandemic, ICT tools could substitute, in a way, the activities planned in the projects, for example, turning some face-to-face meetings into virtual ones. It becomes necessary to establish which tools will be the optimal ones for each kind of activity and, again, offer teacher and student training to make the most of the time they dedicate to participate in the activities.

1.1 Collaborative learning

Collaborative learning it is one of the main objectives of education. Learning to cooperative and collaborate will be fundamental along the school and work life. ICT tools, in their different variations through time, constitute a key element when implementing tasks and projects that include this methodology. In collaborative learning tasks, participants work in pairs or small groups to meet a common goal. Each member is responsible for both their individual objective as well as the rest of the team's ones. (Vinagre, 2010: 24). This means that individual success is only reachable through collective success.

Computer Supported Collaborative Learning (CSCL) is one of the most successful methodological proposals for the transformation of the teaching methods. It establishes the use of ICT as a tool of mediation in collaborative tasks (projects, simulations or problem solving, among others). Apart from making communication and interaction easier, it outstands its ability for the creation of shared knowledge and social interaction.

The roots of collaborative learning can be found in different pedagogical theories that have evolved through time as constructivism, based on Jean Piaget's theories and social constructivism, based on Vygotski's theories. They defended that social and cultural context promote learning, based on discoveries. While Piaget defended that the individuals need to create their own version of reality, Vygotski placed the cultural factor at the centre of his theory as modelling of the cognitive development. The more social interaction, the better knowledge of mental functions.

1.2 Problem-Based Learning (PBL)

Problem-Based Learning is a group work technique widely developed in the last years that appeared as an alternative for traditional learning. In this methodology, we set a problem and identify the learning necessities. Later, we search for information and finally we go back to the problem. Along the process, the students work collaboratively in order to answer the challenge. The process is student-centred, and it is founded in constructivist bases; that is, we assume that learning appears when we contact the environment. The conflict that occurs when we face new situations is the key to get the motivation needed to assume new concepts.

Evaluation of the PBL method is under constant discussion. Since it differs from traditional teaching methodologies, its evaluation must also be different. We can evaluate individually or in groups, even though a combination is the most common and recommendable option. The process of evaluation needs to start from the beginning, and participants must be informed so they are conscious of their own progress during the phases. This is called formative evaluation, and ICT tools can be of great help, since they offer multiple resources to observe the progress and communicate with the students.

1.3 Origins of telecollaboration

The first evidence of telecollaboration implied only e-mail exchange in which students shared information without much reflection about their own cultures. Nowadays, however, intercultural dialogue is at the base of learning in telecollaborative projects, “in which knowledge and understanding are built through interaction and negotiation” (O’Dowd, 2016: 293). Nowadays, in addition, these projects create an opportunity to live international experiences. Consciousness about the potential of intercultural cooperation is growing; as a result, many teachers are integrating telecollaboration as part of the methodologies in their study programmes. We can find examples like the UNICollaboration platform (www.unicollaboration.eu), where university teachers and mobility coordinators can associate and find necessary resources to implement telecollaborative exchanges (O’Dowd, 2016: 295).

In group telecollaboration, the role of teachers is to organise the activities in a proper way so as to benefit the distribution of the collaborative learning, where ICT tools are the learning artifact. However, to start a telecollaborative exchange it is not enough to know how to find partners or which tools will be used in the exchange; it is also necessary to work on our own intercultural and digital competence with the aim of coordinating the exchange with a partner that we have probably never seen face to face. This implies to be able to set the pedagogical objectives of the exchange, as well as be open to other alternatives, willing to adapt to other possible task design or project.

1.4 Erasmus+ projects

In intercultural projects like Erasmus+ we must specify, from the applying form, the tools that will be used to perform the tasks defined and the objectives that we intend to get with each of them. This way, all the partners know beforehand with tools they will use and can get training (for them and for the students implied in the project). For this reason, the annual Erasmus+ programme collects that the actions carried out must try to:

- Improve the level of key competences, with special emphasis on their contribution for a cohesive society and its relevance for the labour market.
- Promote the improvement in quality, innovative excellence, and internationalisation at the level of education, particularly through transnational cooperation amongst education partners.
- Improve language teaching and learning and promote the linguistic diversity in the European Union along with the intercultural consciousness.
- Improve the level of basic skills of teenagers, including those who have less opportunities, as well as promote participation in the democratic life of the European Union.

The need for ICT training fits the conclusions of the ICILS (*International Computer and Information Literacy Studies*) study from 2018, which analysed the digital literacy in different educative systems. These are some of the conclusions:

- Being born in a digital environment does not mean that people are digitally competent. Young people do not develop complex digital competence only for having grown up using digital devices.
- Regarding success in digital literacy, there is greater difference inside a country than between different countries.
- A low socioeconomic level is associated with a low level in digital literacy and computational thinking. This is a risk of a potential digital gap. There are also structural

difficulties in some member states, as a limited number of computers per student, hindering the learning of digital competence.

The Erasmus+ programme sets a specific section to talk about innovative practice in the digital era. In one of the sections, they mention the support offered to digital technologies and to open innovative pedagogies in education, formation, young students, and sport, promoting gender equality and trying to work on the gap of access to technologies.

If we look at actual data, in 2019 in Spain there were 505 KA101 Erasmus+ projects (teacher mobility for training or teaching), which involved 4.872 mobilities in 669 schools. 112 from these projects (22,17%) were developed in the Comunitat Valenciana. Regarding KA229 projects (school exchange associations), in 2019 there were 918 projects in Spain with a total of 23.421 activities including teaching, training and learning. 124 schools in the Comunitat Valenciana took part in these projects (13.5%). Finally, there were 44 KA201 projects (strategic associations – innovation and good practice exchange), 9 of which were implemented in our community. The priorities established by these projects were:

1. Educational value of the Cultural European Heritage.
2. Social inclusion
3. Basic skills acquisition
4. Innovation through ICT
5. Early school leaving.

2. Method

To build our investigation we used a Likert questionnaire for practical reasons. It allows us to easily locate the participants' opinions regarding the topics we are asking about. This kind of survey is a popular psychometric scale in the field of social sciences. It can be used to measure the degree of agreement or disagreement with a proposition, to establish the frequency of an activity, know the importance of a factor or the probability of taking an action in the future. Likewise, it is used commonly to know user experience or the degree of satisfaction with a brand, service, or product. We eliminated the in-between option to avoid the neutral answer bias. It was possible that the interviewed did not feel totally implied in the topic, taking a neutral position as a rule. We wanted the participants to take an active position in their answers.

Regarding the topic of the questions, we adapted them to the variables we wanted to measure: the first block of questions (eleven in total) was about the use of ICT tools in European projects and the training that they had been given (or the need to do so). The second block consisted of nine questions about ICT competence of the students participating in the projects. The third block had four questions about the impact of the sanitary situation over the ongoing projects. Finally, we added four identification questions aimed at locating the schools participating in the study and their experience in European projects. This is the list of questions proposed:

Use of ICT tools in European projects

Answers: 1. Totally disagree / 2. Disagree / 3. Agree / 4. Totally agree

1. Have you used any ICT tools to create work material in a European project?
2. Did you detect any differences regarding digital competence among the partners participating in the project?

3. During the project and final report development, did you use any digital tool (e.g. Sharepoint) to share data with the rest of partners?
4. Did you use any ICT tool to evaluate the achievement of the project objectives?
5. Do you think that digital tools can benefit the international dimension of your school?
6. Have you ever used a digital platform (e.g e-twinning) to share and disseminate a European project?
7. Were The ICT tools used in a European project agreed by the partners beforehand?
8. Do you think it is necessary to have specific training to choose the most suitable ICT tools for every task?
9. Did you get training prior to the use of the tools that you used in the European project?
10. Did you find any difficulties in the use of a digital tool?
11. Did you discover or learn to use any new digital tool during your participation in a European project?

ICT tools and students

Answers: 1. Totally disagree / 2. Disagree / 3. Agree / 4. Totally agree

12. Has the use of ICT tools helped you detect any educative need in your students, either inside or outside a European project?
13. Do you think that the use of ICT tools can contribute for a wider range of students participating in the projects?
14. Do you think that the students have complex technological abilities for being “digital born”?
15. Do you think that students need ICT training prior to their participation in European projects?
16. Do you think that students have enough skills to decide which ICT tools to use according to their objectives?
17. Did you use any ICT tools to promote students’ communication with the project partners?
18. Have you observed any difference about the use of ICT tools depending on the sociofamiliar context of your students?
19. Do you think that ICT tools can help students to create their own learning pattern?
20. Do you think that the students with less competence in the use of ICT tools can be in a disadvantaged situation in their daily routines?

ICT tools and COVID-19

Answers: 1. Totally disagree / 2. Disagree / 3. Agree / 4. Totally agree / 5. The project had finished before the lockdown

21. Did the COVID-19 locking down affect any project in which you were taking part?
22. During the pandemic, did ICT tools substitute any face-to-face activities foreseen in the project (e.g international meetings)?
23. Do you think that in the year 20/21 it will be necessary to modify any action foreseen in the project to adapt it to the new circumstances, turning it into telematics instead of face-to-face?
24. Do you think that the current sanitary situation will make a change in the way the different partners in a project will work in the long run?

Identification

25. School
26. Level/s in which you teach
27. Number of projects in which you have participated
28. Year when you started participating in European projects.

2.1 Sample selection

We selected the sample amongst schools participating in Erasmus+ projects in the last years. The list is public, and we contacted them by phone, starting with the school where we work and their associated schools (cooperative schools in the area), widening the circle to have a sample from the whole region. We also tried to get a representation of primary schools, even though in these cases, the participation of students (specially the youngest ones) in the projects usually gets limited to the implementation of good practice acquired by the teachers participating in the actions.

2.2 Procedure

We achieved a sample of 38 participants from 21 different schools around the Comunitat Valenciana. Some institutions provided more than one participant, since they are big schools with a long tradition in European projects; therefore, they have a team of teachers implied in this kind of activities. The principal aspects we intend to analyse to check our initial hypotheses are:

- Training necessities detected in both teachers and students.
- The use of ICT tools in European projects and the necessity to agree the tools with the rest of participants.
- ICT tools in the field of school international network.
- ICT competence regarding students' sociocultural environment
- The role of ICT in self-learning processes.
- The impact of the COVID-19 in European projects.

From the participant teachers, there are 8 of them who have participated in only one European project, 5 that have taken part in two, 6 that have participated in three actions so far, 7 in four projects and 11 that have participated in five or more projects. Some of the schools that have collaborated in the investigation had been participating in European projects only for two or three years, but most of them have at least five years of experience.

Regarding students, most of the participants are aged 12 to 17. Some of them are out of this range (for example, primary schools focus on pre-primary and primary schoolchildren). In two schools, older students (VET and higher education) participated in the projects.

3. Data analysis

With the aim of quantifying the presence of ICT tools in European projects and the training necessities detected in teachers and students, we examined the data with the help of Microsoft Excel software, which offers some useful analysis tools in a familiar environment. This programme will offer great quantity of data about our investigation.

Focusing on the first block of questions (regarding the use of ICT tools in European projects) we can see that most teachers used digital tools to create materials or to collect the project report and share data with other partners. In the first and the second case the average was 3.57 and 3.08 (over a maximum of 4) respectively, and the most frequent answer 4 and 3 ("totally agree" and "agree").

Likewise, teachers observe differences among the different project partners regarding the use of ICT tools, something relevant if we consider that most of the activities carried out in the projects are digital. That is why one of the principal objectives of the European projects

is to improve the digital dimension of schools, something that will ultimately be positive for the digital skills of students.

Regarding training, we found that 36 out of the 38 participants consider that it is necessary to have specific training to choose the most suitable ICT tools for every task (fig. 1). However, only 22 of the participants said that they had been given training for the use of the tools that they would use in the project. This is a remarkable percentage, but it is far from the 94% that would like to get some training.

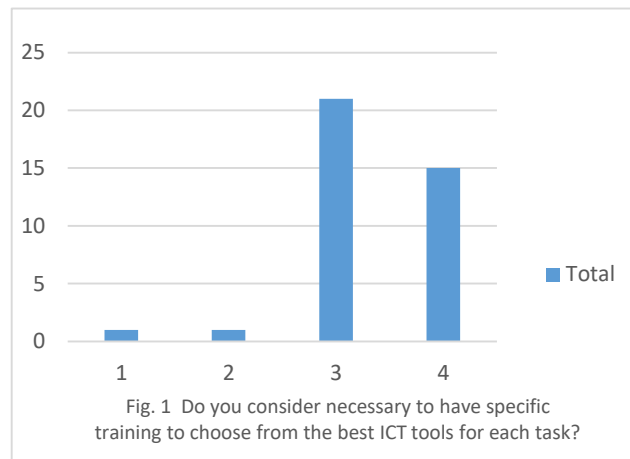


Fig. 1 Do you consider necessary to have specific training to choose from the best ICT tools for each task?

Finally, we found that 55% of the participant teachers found some difficulties in using ICT tools during a European project, although they widely reckon that the participation in this activity helped them to discover or learn to use a new tool. In some of the discussions that we had before doing the questionnaire, many teachers admitted that they had needed to dedicate some of their personal time to the resolution of problems or difficulties caused by the lack of competence in the use of certain tools.

The second block of questions focused on the digital skills of students participating in the projects, from their teacher's point of view. As established in the initial hypotheses, teachers consider that the students do not have complex digital skills only for being "digital born", and that they also need training on the use of ICT tools prior to participation in a European project (fig. 2 and 3)

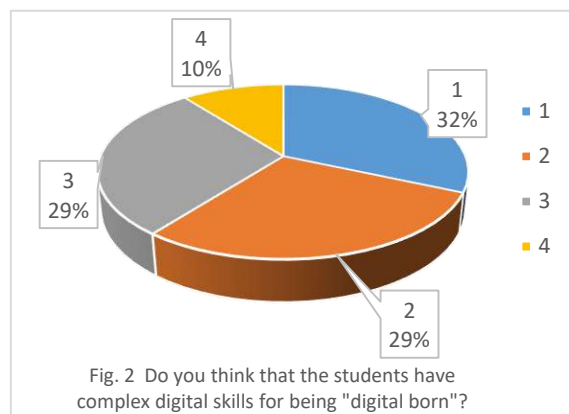
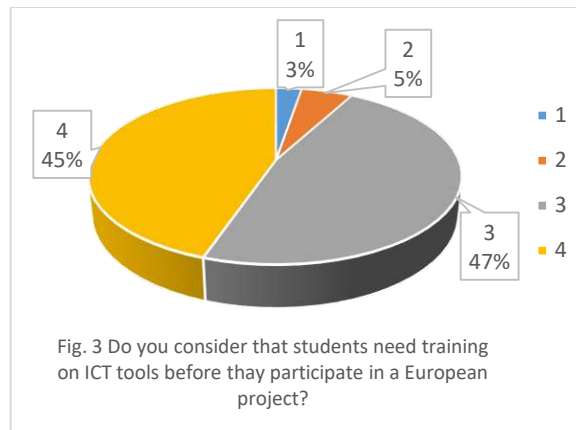


Fig. 2 Do you think that the students have complex digital skills for being "digital born"?



In addition, 84% of teachers consider that ICT tools can help students to follow their own learning path. They also regard that their students can be in a situation of disadvantage if they have a low level of digital competence. 80% of participants detected differences in competences in relation to the socioeconomic context of students.

Finally, in reference to the current sanitary situation, we could see that it greatly affected ongoing projects. 82% of teachers had to modify actions during the lockdown and 92% had to rebuild the planning for the year 20/21. Additionally, 9 out of 10 teachers participating consider that some of these changes can last in time.

4. Conclusions

In the Comunitat Valenciana, the international activities offered by the Spanish Service for the Internationalisation of Education (SEPIE) are expanding. Schools are aware of the opportunities that its participation has, and the impact generated at educational and social level. Families also start to opt for this kind of activities when they see that there is a skilled team behind them

Likewise, the use of ICT tools has become a daily element inside and outside our classrooms in all educational levels. The impact of the COVID-19 pandemic has expanded their use and we have continued to use some of the digital resources that started to use during the lockdown. The *digital revolution* has come to stay, and it is necessary to focus on the strengths and weaknesses that our education system is having to be adapted to this rapid change.

The presence of teachers that have participated in European projects is, in our opinion, key to make decisions to set the improvements that need to be made. This investigation has made it possible to contact a sample of teachers and has offered their opinions on the matter. These are the principal findings of our study:

Most of the interviewed teachers used ICT tools during a European project. They also agree that digital platforms and applications can help the internationalisation of schools. Therefore, it is necessary and important to get specific training on the use of technology and, more concretely, to choose the most suitable tools for every task. However, as we could see in the data analysis, a high percentage of teachers have not been given any kind of training (or it was insufficient) and, in addition, they found difficulties using certain digital tools, having to dedicate extra time to solve problems or propose changes. This fact generates dissatisfaction, and it can lead to discourage some teachers, who see it as work overload or

may feel that they are not competent enough to face the task. Consequently, we conclude that teacher training on ICT tools is a weak point and a prime necessity and must be considered if schools want to participate in multicultural projects. If we declare that the international dimension of schools is an enriching element in education projects, schools must provide their staff with the necessary competences to carry them out in an optimal a coherent way.

In relation to teachers, in addition, we conclude that there are differences between partners regarding the use of digital tools, and that is something to take into account at the time of planning and choosing which ones will be used in the different phases of the project.

About students, we could also draw some interesting conclusions. Regarding the concept of “digital born”, great part of the teachers interviewed consider that the students do not have complex digital skills for growing up surrounded by technology. Therefore, they also need training before participating in European projects and decide which ICT tools to use according to their objectives. It is true that the current generation has almost innate abilities to use some applications intuitively. But it is the teacher’s job, in this case, to help them choose and get the most of them, regardless of every student’s cognitive capacity. In short, the tools we use for educational purposes must contribute, not substitute other key competences for the intellectual development of our students.

We can draw another important conclusion about students. The use of ICT tools can help them to follow their own learning path. This point is key for us, since one of the main objectives in today’s pedagogy is the personalisation of education. To this respect we also conclude that the socioeconomic environment can have a major role in relation to the use of technologies, and this difference can create inequality. Again, the concept of training becomes relevant for the pedagogical and personal development of students. It is essential that all the educative community is properly instructed in the use of digital tools to make students acquire enough competence, regardless of their origin.

Finally, about the current sanitary situation, we conclude that it had an important impact on the ongoing projects, altering some of the activities proposed (for example, international meetings). ICT tools became relevant, since they made it possible that the projects went on, turning face-to-face sessions into telematic ones. Most teachers consider that some of these changes may be here to stay.

Connecting again with the need of ICT training, we want to highlight the differences found between state and private schools with public funding. In the investigation we found out that private school teachers have, in general, received less training in the use of technology than their colleagues in state schools. We didn’t find any difference of this kind in other parts of the study and think it is important to bring it to light. Both types of schools are equal in terms of participation in European projects; therefore, they should offer the same training possibilities. This difference in training can be perceived by some teachers as a handicap if they are considering their participation in a project. Far from being irrelevant, we consider that this perception is very important and can generate inequality between both types of schools.

5. Discussion

It would be interesting to investigate more deeply the type of needs teachers detect about themselves and their students, to be able to detail the training activities that school would

implement. It would be recommendable to interview teachers and students to centralise efforts and resources to cover the real needs of the educative community.

It would also be interesting to establish tools that evaluate more easily the learning outcomes that have been benefitted from participation in multicultural projects and the impact that ICT have had on these outcomes.

European projects manage annually an important budget with is key in the international development of some schools. For this reason, we consider essential to know the real needs of all the community so as to get the maximum profit of the money they get. I would suggest allocating some money exclusively to teachers and students training, money that should be justified with the corresponding learning outcomes.

The current situation demands that the digitalisation of education grows by leaps and bounds. But we will not get a significant change if we do not provide the teaching teams with the necessary tools to carry it out. Education policies must establish a training plan which is realistic and part of the working schedule of teachers. Leaving it to the will of every person creates reluctance, if not frustration before the difficulty of discerning which tools to use and how to do it. Teachers, in general, are eager to move with the times, but it is unavoidable that educative institutions support this movement allocating resources and specialists that help in this important progress.

It is undeniable that the end of the year 19/20 was the turning point of a digital revolution that had started years before, but which was necessary accelerated by the sanitary situation. Schools have a unique chance to reply to the needs of all the community and promote the tools to walk towards a modern educative model, which will be focused on students' competence and collaboration-oriented, and which will use, among other elements, the tools that technology makes available.

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SCIENTIFIC PAPERS

EDUCATIONAL VISUAL NOVELS: AN EXPERIENTIAL LEARNING DESIGN FRAMEWORK FOR TEACHING FINANCIAL LITERACY

Stefano Corradi
eMundus, Kaunas, Lithuania
stefano.corradi@emundus.lt

Vida Drasutė
Kaunas University of Technology, Kaunas, Lithuania
vida.drasute@ktu.lt

Abstract. Widespread diffusion of digital technologies has brought considerable attention to the adoption of video games in education. Many experts and scholars researching this topic advocate for their use, while more and more tech-companies are turning their interest towards the development of educational video games. Although research on educational video games has become quite common, some strands appear under researched. It is the case of “*Visual Novels*” or VN, which are narratively driven games with an emphasis on player choices. Differently from other game genres, VN are characterized by their minimal gameplay, mainly constituted by text and static or sprite-based visual. Despite its educational value, this particular genre has been somewhat overlooked. The present paper will aim to partially fill the gap by illustrating VN’s educational potential. It is contended that their features make VN an ideal mean for the delivery of teaching practices based on *Experiential Learning*. Taking this into account, it will be illustrated a framework for the design of an educational VN aiming to teach Financial Literacy (FinLit). The proposed framework will be adopted within the Erasmus+ project **Promotion of FINancial literacy in primary and secondary EDUcation through gamification and DIGital storytelling (DigiFinEdu)**, which, among its results, will develop a VN for teaching FinLit to 3rd – 6th grade pupils.

Key words: *Visual Novels, Experiential Learning, Gamification, Financial Literacy*

1. Introduction

With the advent of the multibillion-euro video game industry, more and more people are devoting part of their days to video games. Statistical data collected by Europe’s Video Games Industry (ISFE) and European Games Developer Federation (EGDF) shows that around 50% of EU population aged between 6 to 64 years old play video games, spending an average of 9.5 hours per week by playing them. Video games have gained popularity among all age and gender groups. In Europe, the average age of a player is 31.3 years old and 47% percent of players are women (ISFE & EGDF, 2021). These facts demonstrate how video games have now become part of our daily lives. So much that in the past 20 years research on their use in education has grown and changed dramatically (Nadolny et al., 2019). As the engaging power and efficacy of gamification (i.e., “*the design approach of utilizing gameful designs in various contexts [...]*”) (Majuri et al., 2018) in education has been widely acknowledged (Boyle et al, 2016; Manzano-León et al., 2021), researchers have now moved their attention towards detailed experimental research measuring evidence-based outcomes of video games and gamification elements in teaching different subjects.

Among the various subjects covered by these studies, one that is gaining particular attention through almost all education levels (from primary to higher and adult education) is **Financial**

Literacy (FinLit) education. Recently, European financial education policies have been significantly strengthened due to a variety of interrelated factors, such as the population ageing and the consequent pension reforms, the increasing debt burden and vulnerability to over indebtedness (OECD, 2016). Finding themselves tangled in the complexities of modern economics and finance, young adults often show a lack of adequate financial skills (Arrondel et al., 2021). When lacking FinLit, people are more prone to risky behaviours, such as poor saving and spending, excessive credit card use, and bad investment decisions (Lusardi, 2019). It is to counteract this issue that the EU and its Member States have devised policies and national strategies of FinLit education.

Within this context, several studies have been carried out to analyse and measure the effectiveness of FinLit education programs (Hung et al., 2009; Lusardi, 2019; Amagir et al. 2018; Batty et al., 2020), as well as the advantage of educational video games in imparting financial skills to students of all ages (Cheng, 2013; Maynard et al., 2012, Nadolny, 2019). The present research situates itself within this scenario, but from a different perspective, as it does not aim to empirically analyse the effectiveness of video games in FinLit education. The goal of this study, on the basis of previous research already conducted in this area (Kiili, 2005; Øygardslia et al., 2019, Camingue et al., 2020), is to propose a new framework for the design of educational video games, more specifically **Visual Novels (VN)**, for teaching FinLit. VN are video games characterized by their minimal gameplay, mainly constituted by text and static or sprite-based visual. Despite today's great interest in educational video games, VN are largely ignored by research., although they show great potential for teaching practices based on **Experiential Learning**, which have proven particularly effective for delivering FinLit education (Batty et al., 2020; Kaczko & Razen, 2021; Amagir et al., 2018).

The design framework proposed in this research has been specifically outlined for the Erasmus+ project **Promotion of FINancial literacy in primary and secondary EDUcation through gamification and DIGItal storytelling (DigiFinEdu)**. Within this project, which started in February 2022 and it will end in January 2024, this design framework will be put at test for the creation of a VN aiming to teach FinLit to students aged from 9 to 12 years old. The project sees the involvement of an international team with varied skills. It comprises 6 organizations from 5 different countries (Lithuania, Bulgaria, Spain, Portugal and the Netherlands) and it involves teachers, project managers, storytellers, game developers and pedagogical experts. The design framework of this paper has been created to support the establishment of an effective collaboration between the staff members involved.

In order to thoroughly illustrate the rationale and theories supporting the design framework proposed, this paper will be structured in the following paragraphs:

- Paragraph 2 will provide an overview of FinLit definitions in order to clarify its content and objectives.
- Paragraph 3 will aim to make explicit the connection between FinLit and Experiential Learning, explaining why FinLit is better imparted through this teaching methodology.
- Paragraph 4 will move the focus towards educational video games, presenting Killi's (2005) "Experiential Gaming Model" (EMG), a game design modelling created to analyse and create experiential educational video games. It represents the starting point of the design framework proposed in this article and it will be used to analyse an example of FinLit educational video game.
- Paragraph 5 will be concerned only with Visual Novels (VN), showing the teaching strategies within their design.

- Finally, Paragraph 6 will present the design framework that will be adopted in the Erasmus+ project DigiFinEdu.

The authors hope this article will help enrich financial education practices and support teachers and technical staff alike in making new, high-quality educational video games.

2. What is Financial Literacy (FinLit)?

As for many other concepts, there is no single definition of Financial Literacy (FinLit). According to Remund (2010), the “*most basic*” definition should be “*financial literacy relates to a person’s competency for managing money*”. As simple as it may sound, this definition leaves many considerations aside. What kind of competency is referring to? What is meant by “*managing money*”?

Other institutions and researchers elaborated on this general idea, providing more detailed definitions. Below, Table 1, expanded from the results provided by Hung et al. (2009), summarizes the breadth of the conceptual definitions developed over the last 20 years.

Table 1. Conceptual definitions of financial literacy

SOURCE	CONCEPTUAL DEFINITION
Vitt et al. (2000)	“The ability to read, analyse, manage and communicate about personal financial conditions that affect material wellbeing”
Hilgert, Hogarth, & Beverly (2003)	Financial <i>knowledge</i>
FINRA (2003)	“The <i>understanding</i> ordinary investors have of market principles, instruments, organizations and regulations” (p.2)
Moore (2003)	“Individuals are considered financially literate if they are competent and can demonstrate they <i>have used knowledge</i> they have learned. Financial literacy cannot be measured directly so proxies must be used. Literacy is obtained through practical <i>experience</i> and active <i>integration of knowledge</i> . As people become more literate, they become increasingly more financially sophisticated and it is conjectured that this may also mean that an individual may be more competent” (p.29).”
National Council on Economic Education (NCEE) (2005)	“ <i>Familiarity</i> with basic economic principles, knowledge about the U.S. economy, and <i>understanding</i> of some key economic terms” (p.3)
Emmons (2005)	[The] “ability to keep track of a case resources and payment obligations, knowledge of how to open an account for

	saving and how to apply for a loan, basic understanding of health and life insurance, ability to compare competing offers, and plan for future financial needs”
Balatti (2007)	“Exercising in real life situations the ability to make informed judgements and to take effective decisions regarding the use and management of money” (p.7)
Mandell (2007)	“The <i>ability</i> to evaluate the new and complex financial instruments and <i>make informed judgments</i> in both choice of instruments and extent of use that would be in their own best long-run interests” (pp.163-164)
Lusardi and Mitchell (2007c)	[<i>Familiarity</i>] with “the most basic economic concepts needed to make sensible saving and investment decisions” (p.36)
Lusardi and Tufano (2008)	Focus on debt literacy, a component of financial literacy, defining it as “the <i>ability to make simple decisions</i> regarding debt contracts, in particular how one <i>applies basic knowledge</i> about interest compounding, measured in the context of everyday financial choices” (p.1)
The Presidents’ Advisory Council on Financial Literacy (PACFL, 2008)	“The ability to use <i>knowledge</i> and <i>skills</i> to manage financial resources effectively for a lifetime of financial well-being”
ANZ Bank (2008), drawn from Schagen (2007)	“The <i>ability to make informed judgements</i> and to take effective decisions regarding the use and management of money” (p.1)
Lusardi (2008a, 2008b)	“ <i>Knowledge</i> of basic financial concepts, such as the working of interest compounding, the difference between nominal and real values, and the basics of risk diversification” (p.2)
OECD/INFE (2013)	“A combination of awareness, knowledge, skill, attitude and behaviour necessary to make sound financial decisions and ultimately achieve individual financial wellbeing”
World Bank (2014)	“Financial literacy represents the level of aptitude in understanding personal finance.”

What emerges from a quick overview of the definitions shown in the table above is that the various conceptual interpretations of FinLit fall into at least one (if not all) of the following three categories:

1. Knowledge, awareness and understanding of financial concepts.
2. Financial skills and behaviour.
3. Confidence, motivation and positive attitudes towards financial decisions.

It is on the basis of these three categories that the European Union and the OECD have jointly developed a financial skills assessment framework for adults (European Union/OECD, 2022). At the operational level, this means that FinLit is measured through these categories, looking at learners' knowledge, abilities and confidence. This fact represents a good starting point for explaining why Experiential Learning favours the attainment of FinLit competencies.

3. Experiential Learning and FinLit

There are several terms to describe Experiential Learning. John Dewey described it as "learning by doing", while Wolfe and Byrne used the term "experience-based learning" (Gentry, 1990). Beyond these slight differences, Experiential Learning can be considered a branch of constructivism theory, which posits particular emphasis on the concrete experience to construct knowledge (Cheng, 2013). Experiential Learning requires the introduction of active and participatory learning opportunities, inviting students to subvert their traditional role of passive listeners to create meaningful learning experiences (Beard & Wilson, 2006).

Kolb (Bergsteiner et al., 2010) argued that learning occurs within a cycle divided in 4 stages: (i) Concrete Experience, (ii) Reflective Observation, (iii) Abstract Conceptualisation, (iv) Active Experimentation.

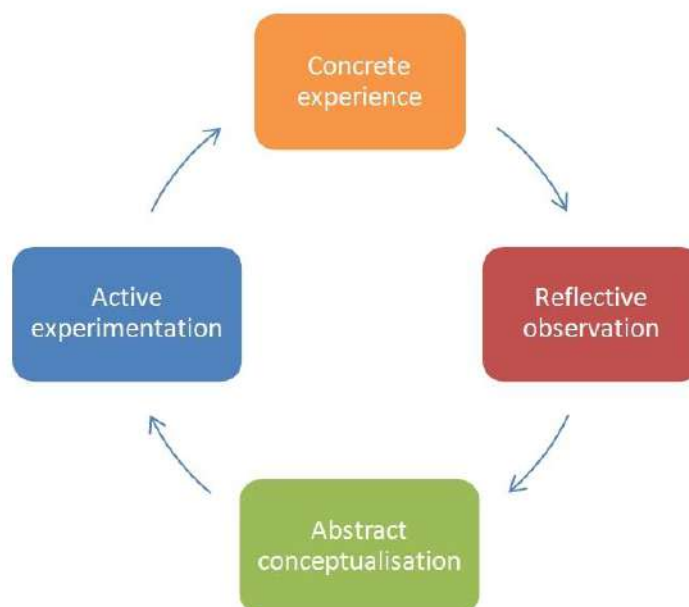


Figure 1. Kolb's cycle.

Within this model, students are invited to experience learning according to their preferences, as they may start the cycle at any point. Where some might prefer to think and then take

action (from *Abstract Conceptualisation* to *Active Experimentation*), others might prefer to take action and then think about the outcomes (from *Active experimentation*, *Concrete Experience* and to *Reflective Observation*) (Endsley, 2020).

With regard to FinLit, the potential benefits of Experiential Learning appear evident when the objective of financial education is made explicit, i.e., the acquisition of sustainable financial behaviours and the achievement of a positive attitude towards financial decisions. Given the applied nature of financial decision making, Experiential Learning appears particularly suited for this task. In fact, it is not surprising to see that policy makers and scholars have recommended to provide young people opportunities to practice and participate in financial decisions, be that at home or in schools (Whitebread & Bingham, 2013). On a similar note, Drever et al. (2015) argue that opportunities to reflect on the experience and to learn from good and bad choices are critical to promote feelings of self-efficacy and confidence, which are drivers of financial well-being and among the FinLit competencies comprised in the EU/OECD “Financial Competence Framework”.

Theoretical considerations aside, there are several empirical studies that verified the effectiveness of Experiential Learning in teaching FinLit. For instance, Batty et al. (2020) conducted a field study to assess the impact of a simulated classroom economy on the financial knowledge of primary education students. The authors analysed the efficacy of “My Classroom Economy” (MyCE), an Experiential Learning approach where students actively participate in a simulated micro-economy. Through this program, students experience the impact of their decisions without the direct imparting of knowledge by teachers. MyCE produced statistically significant results, impacting positively on the financial knowledge and skills of students (Batty et al., 2020). Within this study, test results of students participating to MyCE were compared with the results of a more “traditional” teaching program of FinLit, “Financial Fitness for Life” (FFFL). The comparison revealed that both programs are equally effective, with the advantage that MyCE does not require formal instruction and focus on specific content. Another study evaluating MyCE found that students who participated in that program had 6% higher scores in financial knowledge than those who did not participate (Collins et al., 2016).

Other researchers examined the results of a school-based financial education and saving program, called “I Can Save” (ICS), on primary school students (Sherraden et al., 2009). Some students received a savings account with incentive, while also receiving in-class financial education. The results from this study show that the ICS helped students score significantly higher on financial fitness tests, regardless of parent education and income.

Another effective form of Experiential Learning is the “Stock Market Game” (SMG), wherein students manage real-time virtual investments. This initiative, which uses research and program-provided news updates to invest a hypothetical sum of 100,000 dollars in stocks, has been adopted in secondary schools, where students competed in teams to increase the value of their portfolio (Hinojosa et al., 2010). Harter and Harter (2010) assessed the efficacy of this game and found out that a combination of the SMG and content lessons yielded great results in deepening students’ financial knowledge, skills and attitude.

As proved by these studies, Experiential Learning can make students aware of basic financial planning concepts and illustrate how these concepts apply to everyday life. As pupils and students are more interested in learning about the consumer and financial issues more relevant to their life, through Experiential Learning it is possible to add “real world experience” to the lessons. A good example of this is the teaching practice proposed by Bruhn et al.

(2013), who used interactive classroom exercises dealing with present and future everyday matters of young people. Students also receive homework to do with their parents, such as creating a household budget. Parents of students participating in this program claimed that their children were more willing to discuss financial matters with them at home and they also volunteered to help organize household budgets. Test results showed a small and significant improvement of financial knowledge, with a significant increase of 1.4 percentage points in the intention to save money.

As these studies show, Experiential Learning is both effective in promoting the adoption of conscious financial behaviours, as well as increasing awareness, knowledge, and supporting a positive attitude towards financial decisions. For this reason, video games aiming to effectively teach FinLit education, need to take this methodological aspect into consideration.

4. Experiential Gaming Model (EGM)

There are so many video games teaching FinLit that is easy to get lost. Most of them are adopting, in one way or another, Experiential Learning in their design. But how are they designed? What makes them “experiential”? Killi’s “Experiential Gaming Model” (EGM) (Kiili, 2005) can help us answer these questions. EGM has been created to design and analyse educational video games and it has already been tested in the analysis of FinLit educational video games (Cheng, 2013).

Kiili’s EGM is based on three distinct elements: (i) **an ideation loop**, (ii) **an experience loop**, and a (iii) **challenge bank**. The challenge bank lies at the heart of the model, as it provides the player with the main problem to face and, therefore, the *motivation* to play. The goal of the challenge bank is to sustain players’ motivation by confronting them with appropriate challenges. To overcome these challenges, players try to come up with solutions by entering the *ideation loop*, which is further divided in 2 phases: (i) *preinvative idea generation*, and (ii) *idea generation*. The *preinvative idea generation* refers to a chaotic process of primary creativity, in which ideas are put in practice by trial and error. Through each attempt, the player accumulates experience entering a slightly modified Kolb’s cycle (i.e., the *experience loop*) and returning to the ideation loop with enough knowledge to make more informed decisions (*idea generation*). To teach effectively, a video game must be able to provide an engaging story and enough stimulating challenges to facilitate players’ **flow experience**. *Flow* can be defined as a psychological state where a person “*is so involved with the goal driven activity that nothing else seems to matter*” (Kiili, 2005). Research has proven that the *Flow state* has positive impact on learning. (Liao, 2006; Pavlas et al., 2010).

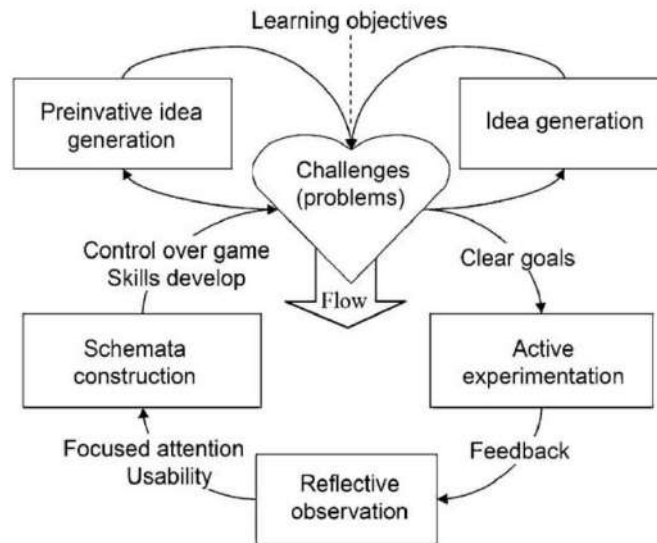


Figure 2. Killi's experiential gaming model (EGM)

Let's see Killi's model applied in practice with the analysis of the online video game "Shady Sam: Loan Shark" (<https://shadysam.com/>). The goal of "Shady Sam" is to demonstrate how loan terms can hurt borrowers who do not pay attention. Players take on the role of a loan shark. The more the customer pay in interest and fees, the higher the score for the game player.



Figure 3. "Shady Sam: Loan Shark" game screen

The gameplay is quite simple. The player receives customers in an office and they come up with a loan request. At this point, the game presents three loan options, with attached monthly fee, interest rate and term length. The goal is to choose the most convenient option for the loaner and the most expensive for the debtor.

The story is minimal and it merely functions as a background to the tasks the game assigns to the player. However, it is essential to provide a *motivation* for the *challenge* proposed, i.e., choosing the right loan. At first, the player is left wondering which could be the best option and it enters the *Preinvasive idea generation*, choosing without enough knowledge of the topic. However, after each attempt, the player's choices become more aware, based on the experience accumulated over the course of the game, which rewards or punishes the player when he or she chooses the correct option or not. As the game goes on, it becomes more difficult, presenting new challenges to the player, that learn about loans, mortgages, microloans and other forms of debt.

The game achieves its purpose by providing sufficient context for the players to immerse themselves in a plausible reality (*Flow state*) and learn through a safe experience the dangers and opportunities of loans. For these reasons, "Shady Sam" respects the principles outlined in Kiili's EGM. Concerning educational outcomes, the game contributes to all the three categories illustrated above:

- It increases players' *financial knowledge and awareness* by explaining through a compelling scenario how loans work.
- It improves *financial skills and behaviour* by teaching to players how to calculate loan interests and by inviting them to always read and ask information when not sure.
- It increases *confidence and attitudes* by rewarding right behaviour, helping players what to consider when they will take the same choices in real life.

Other examples of financial education video games that fit Kiili's model are:

- **Financial Football** (<https://www.financialfootball.com/>) puts the player in the shoes of the financial manager of an American football team.
- **Payback** (<https://www.timeforpayback.com/>) asks the player to imagine how to organize their university studies and future career, avoiding, at the same time, to accumulate too much debt.
- **Spent** (<https://playspent.org/html/>) challenges players to survive the struggle of low-income living, by asking them to manage the one-month budget of a minimum wage American worker with one child.
- **Money Magic** (<https://playmoneymagic.com/>) is designed to teach children basic budgeting principles, by making them manage the expenditures of a magician that need to save money to go to Las Vegas.

Although there are many FinLit educational games, there are no Visual Novels (VN) teaching FinLit. However, we find this to be a shortcoming given the actual educational potential of this genre, which can fit perfectly into the EGM.

5. The Case for Visual Novels (VN)

Visual Novels (VN) are a predominantly Japanese game genre, based on narratively driven mechanics putting an emphasis on player choices (Øygardslia et al., 2020). Compared to other types of video games, their gameplay is rather simple, as it relies on text and static (or semi-static) images to engage players in an interactive story. Within the Erasmus+ project **Promotion of FINancial literacy in primary and secondary EDUcation through gamification and DIGItal storytelling (DigiFinEdu)**, three reasons, already established by Øygardslia et al. (2020), provided the main motivation for the development of an educational VN to teach FinLit:

1. The narratively driven nature of VN makes them a suitable means to provide students motivation to learn and promote their access to the *Flow State*.
2. Since VN are not widely adopted in education, they deserve more study.
3. As these games do not involve complex game mechanics, also teachers and indie game designers may develop one without extensive programming expertise.



Figure 4. Visual Novel's game screen

Lately, researchers have been starting to notice the educational potential of VN. There are some studies (Øygardslia et al., 2020, Camingue et al., 2020) defining design principles and teaching strategies in VN.

According to Camingue et al. (2020), there are 5 main teaching strategies that may be used in combination or as standalone techniques. These strategies have been extrapolated from the careful analysis of over 30 VN, and they are:

1) Choice

In this strategy, learning goes hand in hand with the story progression, which changes according to the player's choices. This technique is based on notions of choice-based learning and self-determination theory, which have positive impact on autonomy, engagement and learning (Eseryel et al., 2014; Sierens et al., 2009). Through "Choice" players learn by experiencing the direct outcomes of their decisions, which are reflected on the story. Usually, video games designed with this mechanism include multiple endings, either "good", "bad", "neutral" or even more if the story is particularly complex. Regarding the teaching of FinLit, choice represents a perfect learning strategy. Financial decisions have a direct impact on people's life and by having the opportunity to make choices (e.g., saving or spending, borrowing money or not, etc.), students may increase their knowledge about financial concepts, learn to adopt financially responsible behaviours and improve their confidence. Although minimally, some FinLit educational video games already adopts this strategy. This is the case of **Money Magic** (<https://playmoneymagic.com/>), a game where you manage the budget of a magician that needs to save money to put on a show in Las Vegas. Players can decide how to allocate the resources. If they save enough, the magician is happy and he has his show in Las Vegas. If they do not save enough money, the magician ends his career.

2) Scripted Sequences

Like “Choice”, “Scripted Sequences” (or “scenarios”) are closely related to the game’s story. However, the main difference is that they do not allow them to make decisions, as they require players to perform the designer’s exact intended actions, before allowing them to progress. They are a form of “guided experiential learning” (Clark, 2005), as they ask players to apply their knowledge to real problems. Within VN, “scripted sequences” usually take the form of interactive cut scenes or in-game quizzes. Generally, “Scripted Sequences” are preceded by instructional dialogues, providing them the knowledge that needs to be applied later in the game.

3) Minigames

Minigames are short video games embedded in another video game. They have been proven to be an effective educational tool for serious games. As such, minigames can employ standard educational design concepts such as assessment and learning mechanics. For what concerns VN, minigames represent nodes in the game’s narrative progression, which resumes only if the player achieved an adequate performance. Ideally, from an educational point of view, minigames should convey educational messages and ask players to complete tasks to assess their knowledge and/or skills. From the perspective of game designing, minigames are a perfect opportunity to give players unexpected and more engaging challenges to keep them engaged.

4) Exploration

“Exploration” invites players to investigate the game’s world to find some hidden objects or artifacts providing fragments of knowledge that make the story progress. In VN, this methodology is seldom used alone. On the contrary, it is almost always paired with another strategy. A probable explanation is that “Exploration” by itself does not provide any direct application of knowledge. For this reason, it has a limited impact on skills’ development.

5) Non-interactive elements

Unlike the other strategies, “Non-interactive elements” does not require any input from the player which passively absorb knowledge through characters’ dialogues or other text windows representing books, diaries, letters, etc. According to the ICAP model (Chi et al., 2014), this teaching strategy is less effective than the more active one.

The teaching strategies outlined above provide multiple means by which to convey any educational content. In the next paragraph, it will be explicated how the design framework proposed in this paper integrates them within Kiili’s EGM to design an educational VN for teaching FinLit.

6. VN Design Framework for DigiFinEdu project

The results presented above provide the background of our design framework, which takes into account:

- The three types of competences promoted by FinLit, (financial knowledge, skills and, confidence), which set the educational goals of the video game.
- The Experiential Learning theory, which constitutes the educational methodology that will be applied to reach the objectives.
- Kiili’s Experiential Gaming Model (EGM), which provides the theoretical approach to apply Experiential Learning in video games.
- Finally, the Visual Novels’ (VN) learning strategies, that translate FinLit educational goals and the Experiential Learning methodology into the logic of VN’s gameplay.

DigiFinEdu Visual Novel (VN) will include a compelling story with decision making elements. The central idea of this game is that players will learn FinLit in an experiential way, through the decisions they will make within the game. Each decision made will bring with it consequences that will affect the development of the plot. In this way, students will learn through experience in a safe environment and by reflecting on their own choices. As demonstrated by previous examples, this practice is expected to have positive effects on students' achievement of financial knowledge, skills and confidence.

As far as the game design is concerned, two phases were distinguished in its conception:

1. Story conceptualization & writing
2. Game design

The first phase concerns the creation of the game's story, which is conceptualized starting from the educational goals. After having identified the educational goals of the game, it will be defined the overarching theme of the story. The theme represents the educational content that the story will address. As the game is about FinLit, it could be, for instance, savings, banking, loans, etc. After having identified the theme, it is essential to define the challenge of the game, the problem that players will have to solve. This represents the core structure, as exemplified by Kiili's EGM. Finally, once the game's challenge has been defined, this will have to be transposed into a story and completed with the activities and challenges that will be launched to players.



Figure 5. Story conceptualization and writing process

Once all these steps have been completed, we move on to the actual transposition of the story into the game mechanisms, i.e., the *game design* phase. Within this phase, writers and designers will collaborate to define the structure of each story's section. In this part, it is essential to keep in mind players' engagement, by balancing the VN's learning strategies

presented above, so that they will enter the *Flow State* and, at the same time, will obtain the expected knowledge and skills.

There is no single solution for game design and the VN learning strategies could be adopted in anyway the designers wish. As DigiFinEdu VN will be divided in at least 8 different chapters (or story sections), for the purpose of achieving the expected educational outcomes, it has been devised a structure that will be repeated within each chapter. The game's learning strategies has been arranged as to mimic a sort of interactive lecture, in which the players/students are initially introduced to the topic and then are challenged to adopt the content learned.

Within DigiFinEdu VN, each chapter will be composed of:

- A “**non-interactive sequence**”, which will introduce the story and the topic addressed by it. This part carries out the task of introducing players to the contents of the subject, helping them to develop the expected knowledge.
- Following this, there will be a “**a scripted sequence**”, which could be a quiz or some simple tasks based on the information provided in the previous stage. This part of the chapter will aim to verify whether players/students have comprehended the topics' presented.
- The next part will include a “**minigame**”. The best option would be to have a different minigame for each game's chapter, so that the game will vary enough to keep players engaged. The minigame section will aim to test students' skills, helping them put in practice the content learned.
- Finally, at the end of each chapter, players will have to take a “**choice**”, which will affect the game's story. This part is the final test to help students develop their skills and acquire their confidence on financial decisions. Moreover, after seeing the outcomes of their choices, students will have the opportunity to reflect on them, making their educational journey even more valuable.

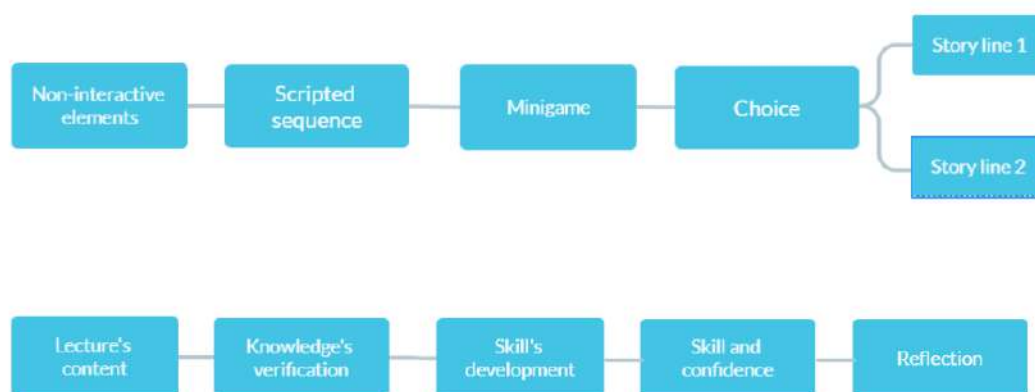


Figure 6. Game design

As previously explained, the DigiFinEdu project involves an international team with multiple skills, having among its members teachers, project managers, storytellers, game developers and education experts. The newly presented design framework was developed in order to enable all these members to use their skills to the fullest and contribute equally to the development of a VN.

7. Conclusions

This paper presented a design framework proposal for the development of an educational VN for teaching FinLit. This was done, first, by introducing different definitions of FinLit to determine its educational goals. Then, it has been explained the educational methodology (i.e., Experiential Learning) usually adopted for teaching FinLit and why it is effective. In the subsequent paragraph, Kiili's EGM was shown to illustrate how to infuse the Experiential Learning theory into educational video games. The educational value of VN was then explained, together with the 5 teaching strategies that are usually adopted in their design. Finally, all these elements were connected to explain the DigiFinEdu design framework.

We argue that the framework proposed here can represent a good starting point for the development of new educational video games. Requiring a lot of technical skills, educational video games are often the prerogative of developers alone. The aim of this article was to present a working structure that allows all the actors necessary in the development of an educational video game to participate equally. We believe that to this end, VN are a perfect genre, as they require less technical knowledge and have a high educational potential.

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REAL-TIME AUDIO ANALYSIS FOR PROCEDURAL 3D CONTENT GENERATION USING PERLIN NOISE

Carlos González

Game technologies and Applications, Florida Universitària, Catarroja, Spain
cgonzalez@florida-uni.es

José Manuel Guevara

Game technologies and Applications, Florida Universitària, Catarroja, Spain
jmguevara@florida-uni.es

José Luis Soler-Domínguez

Game technologies and Applications, Florida Universitària, Catarroja, Spain
jlsoler@florida-uni.es

Abstract. Procedural content generation has been used for years in video games and interactive experiences to generate open worlds and reduce production costs. In this paper, we introduce a new procedural 3D content generation technique. It is based on the real-time analysis of any captured audio. This proposal allows the creation of both terrains or any game object through this audio analysis. This makes it possible to dynamically adapt the user experience or the difficulty of a game depending on the music or audio playing at any moment. We also use Perlin Noise to generate the content maintaining spatial and temporal coherence in this creation.

The combination of the audio information and the Perlin Noise used as a map of probabilities provides customization of the user experience, making a game completely different depending on each music or audio. This way, the user can have different experiences of the same game or interactive application. We present results for both procedural terrain generation and the creation of different game elements, such as hazards or bonuses. All this work has been integrated into Unity and tested with several audios and content.

Keywords: *procedural content generation, audio analysis, Perlin Noise*

1. Introduction

Video games have a growing impact on our society. According to evidence and the latest research, video games are turning into a massive entertainment alternative, with approximately 50% of the EU's population aged 6-64 years old playing video games, equating to approximately 250 million players only in the EU. The weekly average for playtime is 9.5 hours (ISFE, 2021).

This huge user base results in high demand for new games or new content for existing games. Additionally, open-world games are gaining traction due to the sense of freedom and agency that this genre delivers to players. Open-world games are built over a virtual world in which the player can explore and approach objectives freely, as opposed to a world with more linear and structured gameplay (Alexander & Martens, 2017)

Open-world games, opposite to other endless game genres like idle games or clickers, have shown severe difficulties to be escalated (Iosup, 2011) or simply being produced due to the high costs associated with their vast amount of terrain, assets, and characters involved (Takatsuki, 2007). Aiming to face this challenge, widely spread in modern games, Procedural Content Generation for Games (PCG-G) tries to automatize or, at least, help with the creation

of in-game assets and environments. PCG-G could be defined as the automatized creation of content based on different constraints defined and coded by game designers and developers.

There are currently many video games that use procedural content generation. This content generation allows creating elements of the virtual world at run time without having to create them previously and load them in memory. This facilitates a huge release of storage management.

PCG-G has traditionally been applied to these elements, attending to the extensive survey from Hendrikx, Meijer, Van der Velden & Iosup (2013):

a) Textures. In video games, textures are bitmaps. They are binary information that informs a color represented in a pixel of the image, in which the more pixels, the higher the resolution and therefore the higher the quality. Resolutions have been increasing over time, as has the number of textures that can be applied to objects.

Today it's possible to have several layers of bitmaps in different channels making modifications in real-time on the textures. Thus, the character, model, or scenario can undergo variations in run-time, even making effects of particles or volumetric materials. Many games use procedural techniques or tools for most general and material-specific textures.

b) Sound. Even when some initiatives and tools, AI-based, have been developed to make it easy to create music or sound FX for not professionals, it is not a widely extended practice in the game industry. The vast majority of sound content is tailored in a custom way to deliver a specific mood to the game scene.

c) Vegetation. This organic resource is almost always present in outdoor locations, bringing some nature-rooted sensations and being highly rated for its aesthetic traits. Tools for the generative creation of bushes, trees, and grass have been included in most commercial game engines. It's very common to create vast extensions of "green" areas helped by these tools.

d) Behavior. Non-playable characters (NPC) are a key element in games' storytelling. They could help the player or be her/his enemy but always play a relevant role inside the narrative development of the game design. A great number of in-game behaviors have been developed using artificial intelligence techniques. Recently, some more complex personalities have been added to NPC but with inconsistent results.

e) Fire, Water, Stone, and Clouds. These assets, even though they often play a secondary role, represent a significant resource for scenography in games. Usually, fire, water, smoke and clouds are generated procedurally. Additionally, stones and rocks are more than suitable to be created automatically.

All these groups of content are related to the aesthetic dimension of games, that is, the way in which the virtual experience impacts players' emotions and its ability to evoke a certain mood in them.

This article proposes a PCG-G technique addressed to create assets related to a different dimension of a game: environment. The environment could be defined as the terrain where everything takes place. It could be indoor or outdoor.

It plays a relevant role since exploration is the most important game mechanic in open world games (Alexander & Martens, 2017). Outdoor exploration requires huge amounts of terrain in order to provide a satisfactory gameplay length.

The proposed technique is not based on the usual random number generation approach but in an audio input as base for the pseudo-random calculation. To a certain extent, the melody of a song or the speech of a person could shape the environment of a game in a customized, unique way.

2. Procedural Content Generation of environments in games

There are several commercial games that have pioneered PCG-G. One of the first games that generated procedurally the whole game world was *Elite* (*Elite*, 1984), a space exploration and trading game. This approach was also followed by other space-strategy themed games like *EVE Online* (*EVE Online*, 1997) or the famous (or unfamous) *No man's sky* (*No Man's Sky*, 2016) (Figure 1).



Figure 1 *No Man's Sky*

No man's sky, from Hello Games, represents, crystal clear, how important is the basis of the procedural generation. The title represents a procedurally generated open world in which players can explore an unknown universe, which the game itself randomly creates using a "super formula".

Sean Murray, head of Hello Games, was accused of plagiarism for the fact that the formula used was based on an equation published in 2003 by a Belgian plant geneticist known as Johan Gielis. In addition, Murray also adopted the term super formula that had already been used by Gielis himself (Chamary, 2016).

The other genre that has more presence of PCG-G techniques is strategy. *XCom* and *Civilization* sagas have both included since their first versions the procedural generation for the game map, the placement of the resources or the size and difficulty of enemy units.

Other well-known games that have previously used PCG-G to create environments are *Diablo*, with endless dungeons created procedurally and *Minecraft*, because every world is generated procedurally at the beginning of each play session.

In all those examples, the procedural generation of the environment is based on different algorithmic approaches (Amato, 2017). The technique proposed in this paper has an innovative basis since it is originated from an audio fragment seed.

Audio spectrum was considered for the generation of multipurpose terrains in (Aşkın, 2017) using audio spectrum-based height-map data stored in a spiral traversed matrix and procedural smoothing techniques applied. However, in our method, Perlin Noise is also taken into consideration in order to maintain a spatio-temporal coherence of the generated content.

We also extend it to any type of content such as game objects, not only terrains. Moreover, in our work we divide this data by rows and, taking into account the time, the content can move towards us giving the possibility of procedural generation.

3. Method

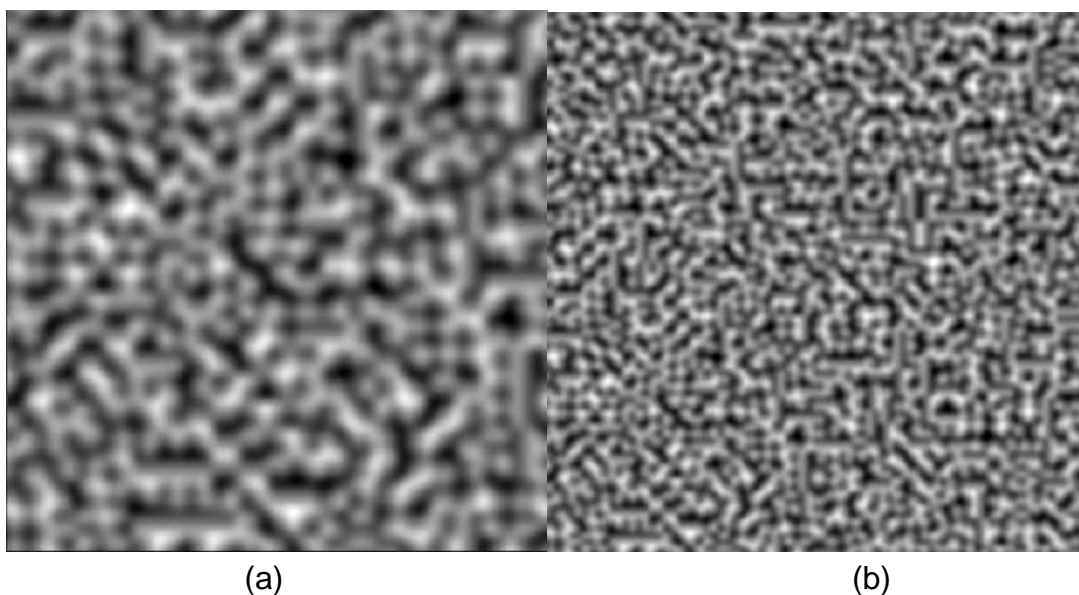
The method presented in this article provides a new way to generate content and terrain in video games by making audio input. In this way, depending on the music or audio that is played, games will be able to offer different versions with different levels of difficulty and provide different user experiences.

Content generation is mainly based on two concepts: Perlin Noise and the audio spectrum. Each of these concepts and how they affect content generation is detailed in the following subsections.

3.1. Perlin Noise

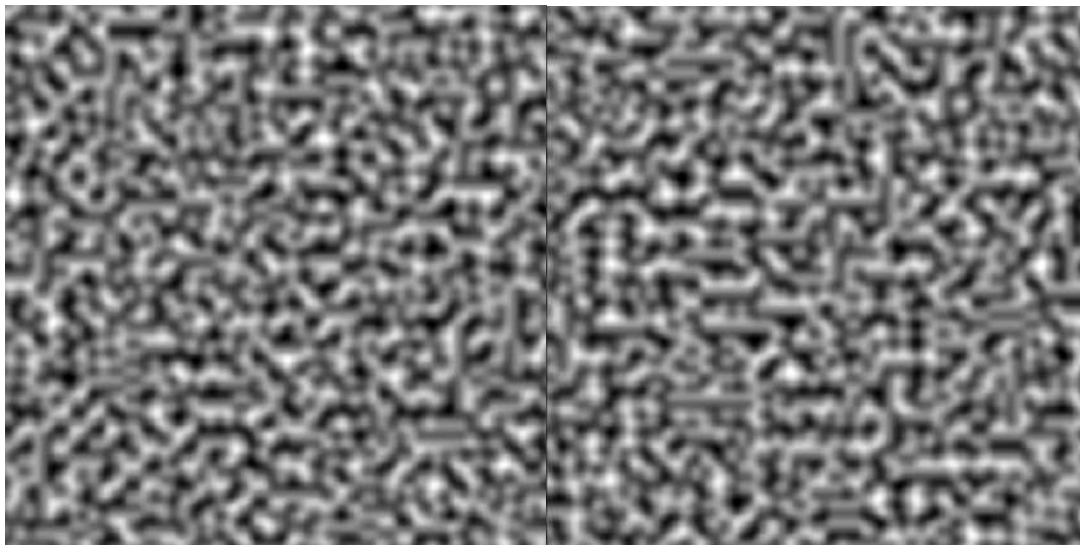
Perlin noise generates a type of gradient noise. Visual effects artists often use it to increase the appearance of realism in computer graphics. It is a pseudo-random function, but its visual details are the same size. Perlin Noise is often used to simulate effects, such as object surfaces, fire, smoke, or clouds, to appear more natural, having a random appearance like natural phenomena.

Perlin Noise has spatio-temporal coherence, so it can also be used for the procedural generation of terrain and content in video games. It also has zoom and pan parameters, which allow us to zoom in/out and move through the noise texture to consider different information about the noise at different times. Figure 2 shows a portion of the Perlin noise texture with the following parameters: a) zoom = 20, x scroll = 0, y scroll = 0, b) zoom = 40, x scroll = 0, y scroll = 0, a) zoom = 30, x scroll = 50, y scroll = 50 and a) zoom = 30, x scroll = -100, y scroll = -100.



(a)

(b)



(c) (d)

Figure 2 Perlin Noise texture samples

As we can see in figure 2, depending on the Perlin Noise parameters, different texture parts are generated. If, in addition, we make the displacement depend on a random variable when running the game, this will cause a different Perlin texture portion to be produced each time the game is run.

3.2. Audio spectrum

An audio spectrum represents the different frequencies present in a sound. This is a representation of a sound considering the amount of vibration at each individual frequency. This spectrum is usually shown as a graph. An example is shown in figure 3.

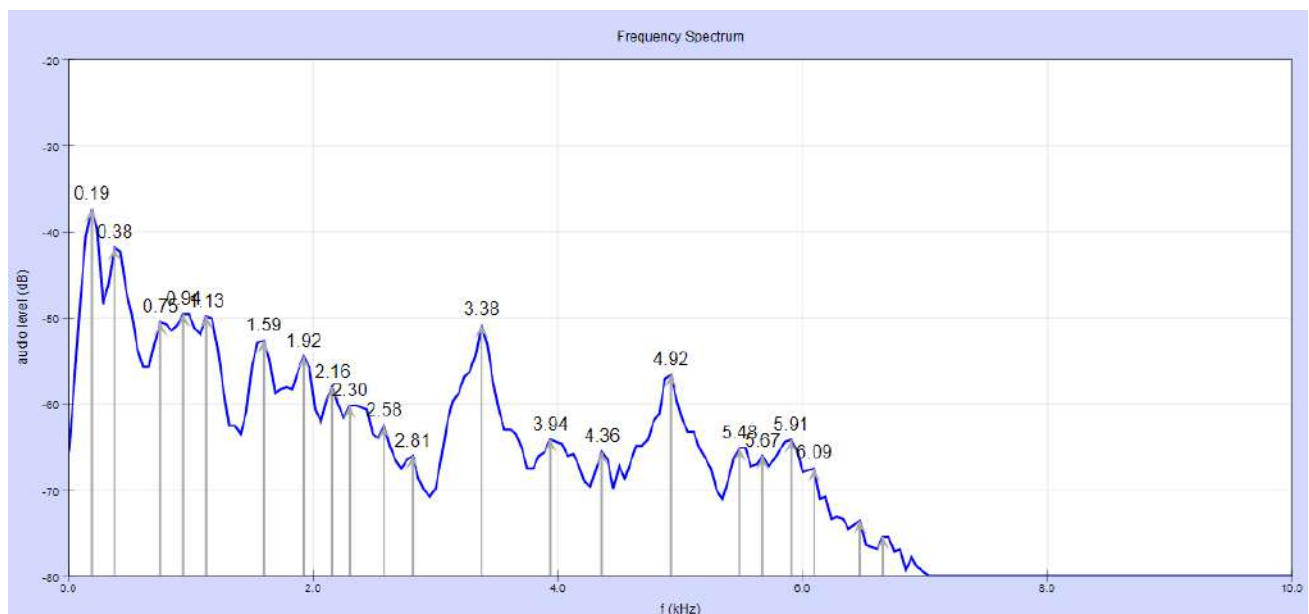


Figure 3 Example of audio spectrum graph

We can obtain blocks of the currently playing audio source's spectrum data and obtain the values at each part of the graph. These values give us a representation of the audio which is currently playing.

3.3. Combination of Perlin Noise and audio spectrum

The information from the texture portions of the Perlin Noise can provide us with probability values if we consider the gray values of the Perlin Noise texture as values from 0 to 1 (0=black, 1=white). Thus, we can take them as a probability value that an object or any kind of content will appear in the game at that point, or even that a terrain will rise according to that probability value.

We can move through the Perlin Noise texture as time progresses, getting new values from 0 to 1 at the same texture coordinates. So we will obtain higher or lower probability values depending on the color obtained in those texture coordinates (black = 0%, white = 100%).

By relating texture coordinates to spatial coordinates in the scene, we can obtain values of an object appearing at a particular point in the scene. And if we make that texture have different displacement parameters as the game progresses, we will make the content move over the game scene.

In addition, if we take as an initial parameter a random initial position on the Perlin Noise texture, a different content generation will occur each time the game/scene is executed.

We can combine the probability values obtained from the Perlin Noise texture with the values obtained at that same instant in the audio spectrum.

So, the final probability that an object appears in the scene will depend on the value obtained in the Perlin Noise texture and the value obtained in the audio spectrum. The formula proposed in this method uses the average value of the audio spectrum values at each instant multiplied by the value obtained in the Perlin Noise texture coordinate related to the spatial coordinate being treated, that is:

$$P(x, y, z) = \text{PerlinNoise}(x, y) * \text{audioSpectrumMeanValue}(t_0)$$

being $P(x,y,z)$ the final probability of creating an object at the scene coordinate (x,y,z) , $\text{PerlinNoise}(x,y)$ the value in the range $[0,1]$ obtained from the Perlin Noise texture at the texture coordinate related to the scene coordinate (x,y,z) and $\text{audioSpectrumMeanValue}(t_0)$ the mean value of the audio spectrum values at each particular moment.

Considering the combination of these parameters the content will automatically adapt to the audio played. Figure 4 shows different moments of a game prototype of the content generation depending on the audio spectrum obtained at these moments. This new content is generated at the end of the plane and moves towards us. Figure 5 shows different frames of a video game using our technique.

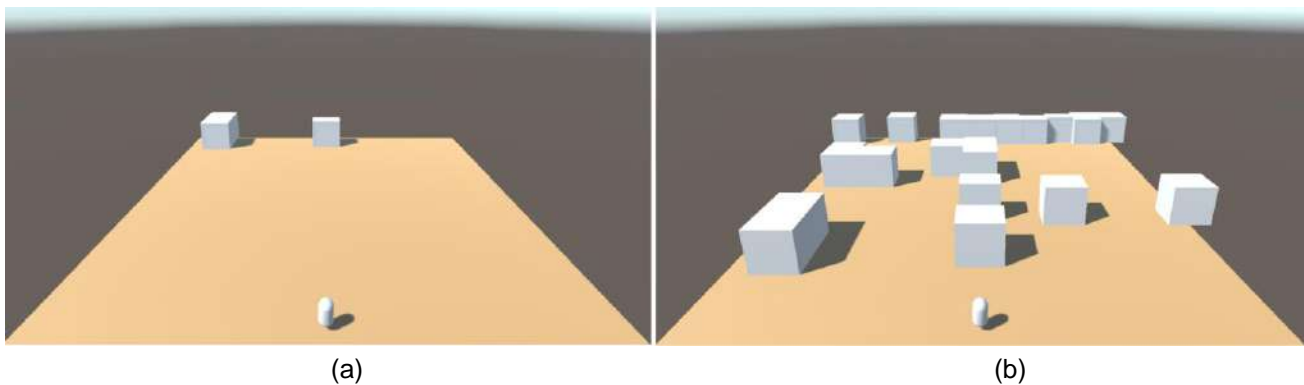


Figure 4 Game prototype generating procedural content with Perlin Noise and (a) an audio spectrum mean value = 1,64 and (b) an audio spectrum mean value = 1,98

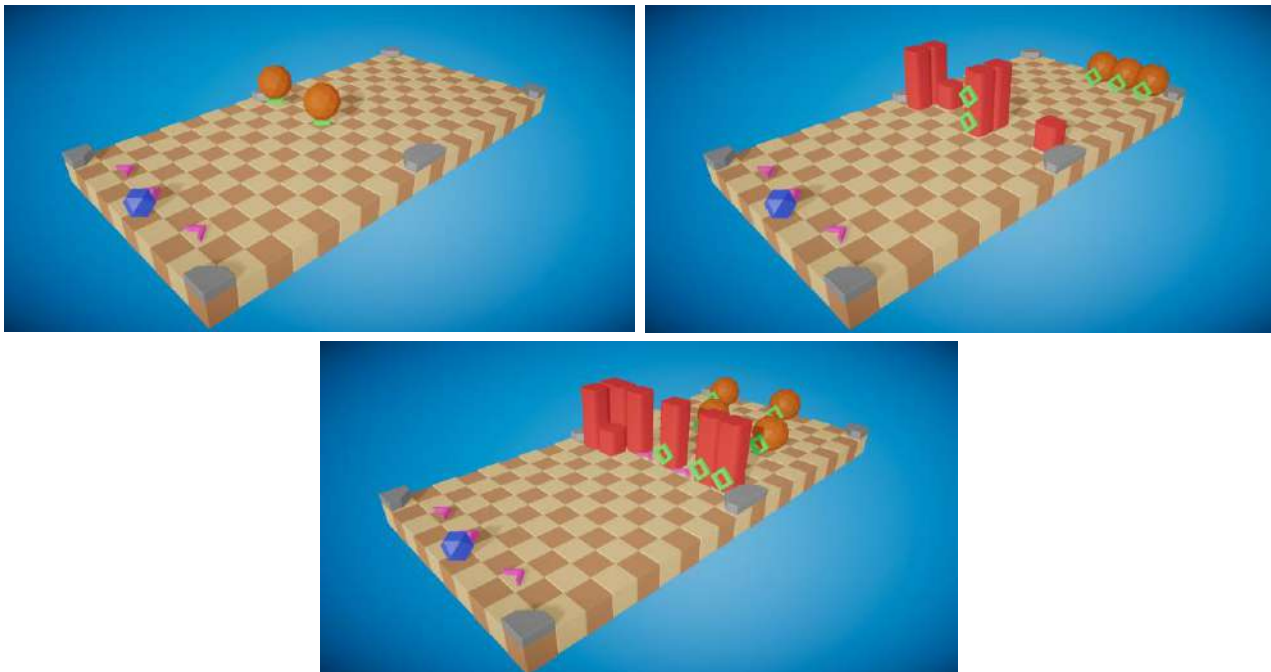


Figure 5 Different frames of the procedural content generation in a video game. Perlin Noise maintains the spatio-temporal coherence and the audio spectrum data defines the quantity of content generated.

4. Conclusions and future work

In this paper an innovative way of originating procedurally generated content for games has been presented. Some commercial game studios are adding PCG-G to their production pipelines. AAA studios, those with huge budgets and teams with hundreds of persons, use PCG-G in order to produce games faster and cheaper (Amato, 2017). For indie studios, PCG-G represents the only way to produce open-world or endless games.

New ways to originate this PCG-G have to be developed in order to offer to players new experiences. In the future, games will be able to offer connections to different inputs, like bio-

signals, music or weather, for example, as a way for customizing procedurally the gaming experience.

Further analysis of audio information for better adaptability in content generation, taking into account different audio parameters, can be considered as future work.

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HOW A STRATEGIC SHIFT GAVE CODIGAMES AN EXTRA LIFE

Sánchez-Coll, F.

EDEM Centro Universitario, Valencia, SPAIN
fsanchez@edem.es

Villagrasa, J.

EDEM Escuela de Empresarios, Valencia, SPAIN
jvillagrasa@edem.es

Donaldson, C.

EDEM Escuela de Empresarios, Valencia, SPAIN
cdonaldson@edem.es

Abstract. Codigames is a young Spanish smartphone game company with an unusual ability to create successful free-to-play video games in a short period of time and easily scalable. The firm is already considered as one of Europe's start-ups with more potential to become a unicorn in the next years, and despite being only 9 years old, it has put up some impressive numbers: recording multi-million quarter revenues; with less than 60 workers; and reaching the number one spot in the US video games market. The secret of this accomplishment is based on, firstly, a radical strategic shift from the classic vision of 'author games' ('hardcore' style) where the company started to compete in the first moment, towards a more general and democratized vision of gaming ('casual' style), therefore reaching the great mass of players who usually look for more collaborative and social games. Normally, these types of games are quite easy to handle and understand, presenting a similar gameplay which, not only extends the life cycle of the games, but also improves the bond and money expended by the user. Secondly, on the work methodology applied, where several games (that apparently seem individual pieces) are developed at the same time, reusing the technological development and players' know-how gained in previous projects to, therefore, generate quick and quality launches. And thirdly, on their ability to carefully and in detail monitor, through statistics and data analytics, the success or failure of the different games, selecting and replicating its projects accordingly and improving the parts that do not achieve the desired performance. So far, Codigames is the most successful company of Marina de Empresas, a unique consolidated business ecosystem placed in Valencia (Spain) and formed by a business school, a start-up accelerator, and an investment vehicle gathered in what has become as one of the most important and vibrant entrepreneurial hubs of the Mediterranean area. The case allows the discussion of important concepts such as how an entrepreneurial company can scale in size while retaining the 'power of being small', how the environment (understood as entrepreneurial ecosystem and financial circumstances) can support and act as a lever for change, the importance and types of strategic change within a firm, the relevance of implementing ambidextrous management styles to apply them, and the understanding of the current video game market deeply affected by the new paradigm driven by the increase of data-user privacy protection.

Keywords: video games, strategic change, monitor, management style, data-user privacy protection.

1. Introduction

According to Newzoo (2021), a reputed video game market research company, in 2021 there were 4.6bn active smartphones in the world, what represented a year-on-year increase of 5.7%. Among them, 703.5mn were 5G-ready (15%), what embodied an impressive year-on-year growth of 230.9%. Their projections were equally spectacular given that by 2024 they

forecast that there will be 2.4bn active 5G-ready smartphones of a total global amount of 5.3bn (45%). Consequently, as mobile penetration rates and smartphone use accelerates the mobile game market, making it bigger and bigger each year, this, at the same time leads to higher revenues for a hyper competitive and fast-moving industry with an estimated global number of players of 2.7bn by the end of 2020 and 3bn by the end of 2021. Actually, the most important video game market segment is the smartphone one, before other market segments defined by the device used such as consoles, PCs or tablets. Statista (2021), a company specialised in market and consumer data, explains that the smartphone games accounted for almost 50% of video gaming revenue worldwide in 2020. And these revenues grow year on year because, as Newzoo states, the mobile games revenues in 2020 were \$86.9bn and in 2021 \$90.7bn while they are expected to cross the \$100bn milestone by 2023, according to Statista.

Spain is a small but growing market where, according to Newzoo (2018), there were 24.6mn players who spent \$2bn in 2018. In this market, and following the market description of the White Paper on Spanish Video Game Development (2020), there were 655 active studios at the end of 2020, of which 66% were young companies, between 2 and 10 years old. While only 22% have more than ten years of longevity. Of a total turnover of €920mn in 2019 (a 13% more than in 2018), up to 86% of the studios had a turnover below €2mn per year, and even, 61% of studios are below €200k of turnover per year. In fact, in the whole country, only 4% of studios have a business volume of more than €10mn, and they are extremely important as tractors in the sector because their turnover is equivalent to 70% of the entire industry (i.e., 70% of €920mn = €644mn). In this understudied Spanish context, we have limited knowledge of how are the successful and unsuccessful strategies implemented by the studios. Therefore, the aim of this paper is trying to bring some light of how a Spanish studio, Codigames, was able to breakthrough in the Spanish and even European industry shifting an erroneous strategy. The redesign of an unsuccessful strategy implies positioning the company in a certain game category (*'casual'* games) and in a determined genre (*'idle'* games). These decisions will enable the firm to target a customer who will validate the proposal of value of the company with its own perception. Consequently, if the company can keep on working on that niche of value for the gamers, it will have the leverage to scale and monetize it. As we will show, in the case of Codigames, there is a sharp contrast between the old and the new strategy, what in the end establishes the difference between losing or earning money, and the difference between bankruptcy and a hard-earned success stole from the jaws of defeat.

2. The story of Codigames

2.1 The early days of Codigames.

The founders of Codigames were Francisco José Martínez Gómez and Zacarías Gómez Ayala, two cousins born in Murcia (Spain) who grown up together. When Francisco, the current CEO of Codigames, was 9 years old, he was given a computer with which he began to learn programming. The present at the time was something very simple, but would turn out to be a catalyst that would lead to the development of an avid interest in video game creation. The main focus of the games that Francisco originally created were designed to be played on a browser and, at the same time, he began to practice and expand his knowledge with game typologies such as the Role-Playing-Game (RPG). This RPG is a type of video game where the player assumes the role of an imaginary character (or characters) that undertakes

a quest in a fictional world with its own narrative. Francisco's knowledge and ability to create these types of games (largely inspired by a Japanese cartoon series) allowed him to generate a modest, yet for him significant, monthly revenues of €400 to €500 from Google advertising (while being in high school). Meanwhile, his cousin Zacarías, the current product manager of Codigames, studied computer applications and developed a more artistic approach to video games, since he was the one who drew the comics that both came up with to develop their RPGs.

Francisco soon demonstrated his vision for business as he perceived the arrival of the smartphones as the ideal device where launching and playing its creations. Therefore, he proposed to Zacarías to make their first commercial video game for iPhone, *'The Mordis'*. This game was launched in the Apple Store in June 2012 and was very well received, as it got more than 25k downloads in less than 10 days being able to pass the 100k downloads mark. In addition, it won the Wiideojuegos Competition 2012 in Bilbao and was finalist in similar contests organised by the Polytechnic Universities of Madrid and Barcelona (for a comprehensive list of games launched, its style, way to monetize, and results obtained from 2012 to 2020, please see Table 6). In December 2012 they launched their second game, *'Cross the line'*, which again got more than 100k downloads. However, it is worth mentioning that both games did not help Francisco and Zacarías to generate high revenues.

In any case, this early success was what encouraged them to try to professionalize their passion, creating video games, setting up a company (Codigames) in 2013. In March of that year, they launched their third game, *'Infinity Space'*, which got more than 300k downloads but only €50k (a considerable economic figure for that moment, but very poor for the sustenance of a video game company). The next step was trying to make their firm bigger, so they needed funding given that a video game start-up is very intense in the use of cash in its first years. This type of business must pay salaries to qualified game developers to create projects that will take months to arrive to the market and generate positive cash flows. Therefore, in 2013 they started to apply to several Spanish incubators. They were finally accepted in May 2013 in Lanzadera, which is part of a greater entrepreneurial hub called Marina de Empresas: a unique consolidated business ecosystem placed in Valencia (Spain) and formed by a business school, a start-up accelerator (Lanzadera), and an investment vehicle (Angels), gathered in what has become as one of the most important and vibrant entrepreneurial hubs of the Mediterranean area. Curiously, that was the first edition of the accelerating program of Lanzadera and they were specially lured by the conditions it offered, for instance until €200k in a convertible loan, something that at that time was clearly above the conditions offered by other incubators in Spain at that time. In particular, Lanzadera conceded them a €95k loan.

2.2 The mobile video game categories and genres.

In general terms, as accepted by game scholars (Chess and Paul 2019; Hjorth and Richardson, 2020), game journalism (Heinze, 2017) and even popular discourse, the world of games can be classified in three major groups: *'casual'*, *'midcore'*, or *'hardcore'*, depending on the difficulty and depth of the game narrative. Hence, a *'casual'* game is defined by its mass market appeal and its straightforwardness, being a perfect example of this category the broadly known *'Candy Crush'*. These games have simple mechanics and rules which could be learnt quickly by the gamer making them ideal for killing time in a cue or while commuting

home, what derives in a spontaneous interaction and in irregular playing periods²⁵. This would mean that the *'casual'* gamer spends much less time playing than *'midcore'* or *'hardcore'* players, and that this time is "less intense". The next type is the *'midcore'*, which requires certain skills and strategy to progress, what implies that the player must invest a greater amount of time and effort than in the *'casual'* category. This type of games usually offers multi-player experiences, resource management, and what is known as games inside the own game (such as a quest for an additional content to continue advancing in the game). The final type is the *'hardcore'*, which requires a high investment of time to learn how to play the game properly, what leads to a great bond between the player and the game. Due to the required dedication, there are not so many players in this category but those who play have an enormous engagement driven by their desire of proving their ability and complete the full proposed quest by the developers of the game. The *'hardcore'* gaming sessions are then much longer than in other categories because the storytelling and the action cannot be easily paused and then picked up later. For instance, this type of games offers Multiplayer Online Battle Arenas (MOBA) where several players form teams that compete against each other. Therefore, if each player controls a character that can display a set of unique abilities being its contribution important for the final battle result of its team, it would not be very recommendable to abandon the "battlefield" for a break. These types of games are used for instance for *'e-sport competitions'*.

As can be observed, one of the most important aspects of these three categories is the time that each type of player is willing to commit to the game, because the higher the retention time, the higher the potential revenues will be for the developer. In this sense, the video game industry classifies them into three types: *'small fishes'*, *'dolphins'*, and *'whales'*. A *'small fish'* spends in the game an average of just €1, being in this category around 80% of their players. A *'dolphin'* spends an average of €5, and they represent 15% of their audience. Finally, the *'whales'* spend €20, and meant 5% of their gamers²⁶. Consequently, in the *'casual'* games, due to its game typology and functionality, there will be many more players which similarly will be willing to spend little money. That is to say, their players will be mostly *'small fishes'*. In contrast to the *'hardcore'* games, where the gamers, in this case *'whales'*, will be far fewer, will spend much more time in the game, and will make wider contributions to the revenues of the developers due to its high commitment with the game. However, it is important to mention that developers who want to create a *'hardcore'* game, must also take into account that they will have to commit lots of resources to create the demanding quality that this type of players want.

In terms of genre, there is an enormous variety in the industry, such as *'puzzle games'*, *'hidden objects'*, *'adventure games'*, *'strategy games'*, *'arcade games'*, *'action games'*, *'trivia games'*, *'car games'*, *'board games'*, etc. In the case of Codigames, the company initially aimed at position itself between the *'midcore'* and the *'hardcore'* category and in genre of the *'strategy games'*. The election of this genre was not casual, because at the time, it was very popular, with more than 50% of the video games of the #top 10 in the mobile sector belonging to such *'strategy games'* genre. In addition, their games also offer another characteristic or specificity of the genre: they are *'idle games'*, also known as incremental games, what means

²⁵ There are even other games which a nearly flat learning curve and even more simple dynamics called *'hyper casual'* games, but in this paper we are only going to consider the *'casual'* game category.

²⁶ Then, if we do the numbers, the average player of the industry would spend €2.55 ($€1*80\% + €5*15\% + €20*5\% = €2.55$). For its part, Codigames, with a daily average revenue per user (DARPU) of €1.25 and an average User Retention (UR) of 6 days, has an average lifetime value per user of €7.5 ($€1.25*6 = €7.5$), around three times the average of the industry. Moreover, according to Francisco, if we only take into account the paying users, this lifetime value per user in Codigames would grow to €12.

that the game can progress with no compulsory continuous interaction from the player, leaving the game running by itself with minimum or zero player interaction. Thus, interaction with the game, while often useful for progression, is optional for extended periods of gameplay. Imagine that there is a strategy game called *'Hotel Empire Tycoon'* (actually, this game was launched by Codigames in 2020) where the player must set several hotels in a street in a fictional city and then fictional tourists would appear occupying the rooms in the hotels, what will start to generate revenues. Thus, the *'idle games'* genre means that when the player switches off the device, the game carries on, what means that new clients arrive to the hotels, keeping the flow of cash into the coffers of the gamer (or the "hotel tycoon"). These "overnight" revenues will help the gamer to later on open new hotels, improve the old ones, and generate more revenues, which increases the engagement and interest for the game (and therefore, its retention and potential monetization).

2.3 The business model of Codigames: social games, the free-to-play model, and the marketing applied by the firm.

Codigames was officially founded as a registered company in 2013 with the idea of offering "mobile social video games" which were able to provide real time play, in a multiplayer mode, and in a cross multiplatform environment. This meant that several gamers could play at the same time, given that the software was able to work in different platforms. Their target customer would be a western man, among 18 and 35 years old, who plays regularly and likes the multiplayer mode. Therefore, as they described their games in their first pitch deck in 2014 *"Our video games allow you to play with your friends and acquaintances regardless of the device they have (Apple, Google) and also simultaneously, where distance does not matter"*. This social element was key in the Codigames strategy because it meant that players could communicate and play together, competing or cooperating among them, what eventually would create a sense of community that in the end would help to keep players coming back to their current and future games.

The first two games created by the founders of Codigames (*'The Mordis'* and *'Cross the Line'*) were monetized via digital download, where customers bought their games online and downloaded them directly into their devices. However, Francisco thought that the social component of their games would be able to generate a longer life cycle than individual or single-player games, where contribution from only one player is expected along the course of the gaming session. Therefore, their social games were perfect for a model of free-to-play (F2P) business, which actually was the method selected when they started to develop games as Codigames in Lanzadera. That is to say, they moved from a buy-to-play (B2P) model, incipiently applied in its first two games, to a F2P model, much more related to the strategy they wanted to follow as a company. As Francisco explains: *"in a game that is paid, the player is motivated to play, because at least the gamer wants to amortize the cost of the acquisition"*. However, in a F2P game, it is not required a purchase to play. Therefore, the game has to offer an enormous quality and enjoyable experience from the very beginning to create an immediate connection with the player. Consequently, developers must spend a greater energy and focus to create this instant bond. Furthermore, this business model has the advantage that piracy is avoided.

But, how does Codigames monetize a F2P game? In a double manner. First, through microtransactions or "in app purchases", where the game offers to the player the opportunity to spend incremental quantities of cash (in a range from €1 to €100 in the case of Codigames) to make progress more quickly or gain access to new weapons or powers, what in the end is

going to improve the game experience for the player. And second, through advertising in the game or “in app advertising”, which could be banner advertisements, product placement or, in the case of Codigames, commercial breaks such as advertising videos. Therefore, Codigames earns money each time a user clicks on an ad or installs the app that is being advertised. This advertising space is rented by Codigames to online advertising platforms such as Meta (formerly known as Facebook) and Google. These platforms can adjust with great precision the type of advertisement to the player who is going to view it, because each smartphone has an IDFA (IDentifier For Advertisers) in the form of a string of numbers. Then, this IDFA serves to build very accurate user profiles as the owner of the smartphone moves from app to app. And of course, this very same technique and these platforms, are also used by Codigames when they want to advertise online their own games in other games of the competence. Besides, following the F2P philosophy of generating an enjoyable experience and connection with the player, Codigames policy regarding the commercial breaks that appear in the middle of their games strictly determines that they do not have to be intrusive. Hence, the player must decide if he/she wants to see them or not. In other words, the decision to advance faster or not it will be always up to him/her, and it will depend on buying some available “advantages” or see some ads. Anyway, as can be observed, the basis of the whole Codigames business model is to make the game to be satisfactory and enjoyable for the client, because if they do so, the player would like to play more time (i.e., increasing the “retention time”), what will make potentially the revenues grow (i.e., as they will spend during more time). Said differently, the more “retention time”, the higher likelihood to transform the ‘small fishes’ into ‘whales’.

2.4 The work methodology and the cells.

In order to develop games, the employees are organized in individual cells which work independently in different projects. Each cell has between 8 or 9 workers with a product manager (or leader of the cell); three people in charge of the most important areas for the development of a game: a game designer, a lead artist, a lead programmer; and several other artists and programmers (who give support to each of these three areas). The process has four differentiated stages. 1) it starts with the ‘*selection*’ of the project among several ideas, 2) what is followed by the design of a ‘*prototype*’. This prototype has to incorporate intern mechanisms to attract gamers (phase of acquisition of players), to keep them playing for as long as possible (retention phase), and also, to define some procedures so that the player ends up paying some extra content (monetization phase). This is usually called “soft launch”, as the game, which is not finished yet (i.e., it is in a beta version), is offered after 2-3 months of work to only some players in a sort of focus group (it is important to mention that the players are not aware of it, otherwise they may not want to play a game not fully developed –as for instance, only one part of the universe, city, or levels are generated–). With this, the firm aims to measure and improve the prior phases of acquisition, retention, and monetization (for example, deciphering what is valued and what is not valued by the user, what increases its retention in the game, what makes the user paying more, etc.). 3) Next, the game is ‘*developed*’ for 2-3 months more, where a continuous testing will be a constant throughout the process. When the final product is ready, it is eventually “launched worldwide” in the app stores of Apple, Google and Amazon. 4) After the launching there is another team made up of around 8-10 people (which work transversally in all the portfolio of games released by the firm) dedicated to ‘*maintain*’ the game, launching upgrades, adding new contents, and correcting errors, with the objective of extending its life.

2.5 The first and the second investment rounds. The difficult times and the success.

In 2014 Codigames went for its first investment round, they wanted to keep the company well capitalized in order to face their objectives of creating new video games that allow them to scale up their company what, in the long term, will make Valencia city a reference for the video game industry. In this first round they received €345k and the founders, even though diluted, kept 51% of the shares. They were invested by Angels, the investment vehicle of Marina de Empresas which obtained a 22% of the company, and by some Business angels, who got 27%. These Business angels were close to the main sponsor of this entrepreneurial hub, Juan Roig, which particularly is the sole shareholder of Lanzadera and Angels. Moreover, it is worth mentioning that Juan Roig is also the majority owner of the most important supermarket chain in Spain, Mercadona, with the highest market share of the country (with almost one third of it). The fact that Codigames was headquartered in Marina de Empresas help them to understand the business model of this successful supermarket what inspired them a lot in the way of organising their company, as well as in shaping their business philosophy. For instance, they organised their 2014 funding proposal deck using some Mercadona controversial concepts such as that a company does not exist principally to serve their shareholders. Following Mercadona's model, a corporation should have the purpose of benefitting all their stakeholders: clients, employees, suppliers, society/community, and shareholders. A vision that permeated the founders of Codigames.

Table 1 First investment round

2014 First Investment Round	
ANGELS	€155,000
BUSINESS ANGELS	€190,000
	<u>€345,000</u>

Source: Own elaboration using internal information of the company

Table 2 Second investment round

2016 Second Investment Round	
ANGELS	€270,000
CAIXA CAPITAL RISC	€270,000
FARADAY	€215,000
BUSINESS ANGELS	€45,000
	<u>€800,000</u>

Source: Own elaboration using internal information of the company

In 2016, even though the company had not reached black figures, the sales were promising. In the previous year, they had surpassed the €500k mark and in 2016 they were in route to the €1mn milestone. Actually, they finished the year very close to it with sales of €977k. Therefore, they decided to go for a second round of investment in order to contract more artists and programmers to create new working cells. In this second round, they received €800k from several investors. The former shareholders accompanied the round. Angels went in with €270k and the Business angels contributed with another €45k. Additionally, Caixa Capital Risc and Faraday (two well-known names in the Spanish venture capital arena) got in with €270k and €215k respectively. The issuance of capital of this second round, done in 2016 but publicly recorded in 2017, diluted the position of the founders to only 41% of the shares. However, Francisco was the still the CEO and kept its artistic and strategic autonomy. With enough cash in the coffer the company faced 2017 with enthusiasm, but this year was the worst year in its history. Not only the sales were below expectations, but they also had lots of problems to launch new games (in that whole year only two new games were added in their portfolio) and when they were released, they obtained poor results. Consequently, they registered a negative result of -453k, their worst losses ever what burnt lots of their cash leaving the company in an extremely complicated situation at the beginning of 2018. At this critical moment, Francisco showed his leadership. First, he never lost faith that the company

would get one of his games into the #top 3 best sellers (something stated by Francisco to its shareholders since the first investment round in 2014). Second, he was able to withstand with shareholders pressure, who were worried by the poor results, without transmitting it to his team. Even when the idea of closing the company if results not improved in the short term was on the table. And third, and more important, he decided to finally shift the strategy of the company, moving from the 'midcore' game category to the 'casual' category, what was an absolutely game changer for the firm (something stated by Francisco to its shareholders since the second investment round in 2016, but that was difficult to apply due to the big investments –technical but also related to the selection of certain workers– in 'midcore' games since 2014). In fact, this change ended up allowing the firm to obtain more revenues (due to a better fit with the clients) and more launches (due to the less difficulty to develop these games, jointly with the use of synergies/reuse of the developed knowledge or parts in previous games, to develop "similar" ones though perceived as individual pieces by the players)²⁷. Thus, in 2018, they were able to launch seven new projects, three still in the 'midcore' category, but four already in the 'casual' segment. It was in this 'casual' market where they had its major success: 'Idle Airport Tycoon' reached €2mn in sales. The first time for the company.²⁸ The cash was flowing again, and the pressure started to cede as the company registered black figures for first time at the end of 2018. Then, in April 2019 the company achieved a success of international dimensions: 'Idle Supermarket Tycoon', a 'casual' mobile game focused in scaling up a supermarket, reached the number one spot of downloads in the strategy category in USA. This made Francisco's old promise come true and sent his company to stardom as this game alone was able to pass the mark of €20mn. Again, the first time for the company. It is worth mentioning that Juan Roig, as previously mentioned, is the sole shareholder of Lanzadera and Angels and therefore, was the majority investor of Codigames till the date. But also the majority owner of the most important supermarket chain in Spain, Mercadona. Thus, it is curious that Codigames reached its best performance with a game based on the core business (a supermarket) of its main investor, Juan Roig. As Francisco explains: "we thought it could make sense to create your own supermarket and get rich with that business". The company closed 2019 with a sales record of €44m, which was beat again next year when they reached €71mn sales.

Table 3 Condensed consolidated statements of income 2013-2020 (in euros)

Fiscal Year Ending	2013	2014	2015	2016	2017	2018	2019	2020
REVENUES								
Sales	€10,983	€224,010	€512,534	€977,952	€614,002	€1,578,451	€44,323,084	€71,857,862
Other revenues	€0	€0	€179	€0	€43	€4,414	€644	€821
COSTS and EXPENSES								
Salaries	€39,049	€199,701	€358,064	€485,858	€619,976	€579,467	€895,893	€1,880,687
Other expenses (marketing and local taxes)	€28,301	€228,036	€328,187	€711,703	€436,514	€479,892	€23,290,576	€45,970,214
Depreciation	€230	€2,210	€4,624	€5,966	€8,248	€7,242	€8,217	€17,802
Other costs	€0	€0	€0	€14,098	€0	€0	€0	€0
OPERATING INCOME	-€56,587	-€205,336	-€178,161	-€239,673	-€450,693	€516,264	€20,129,242	€23,989,980
Interest expense and others	€182	€675	€1,140	€1,052	€3,227	€0	€0	-€37,298
Change in foreign currency translation	€133	-€1,959	€8,114	€12,681	-€678	€7,981	€201,106	€1,337,114
INCOME BEFORE TAXES	-€56,902	-€204,052	-€187,415	-€253,406	-€453,242	€508,283	€19,028,136	€22,690,164
Taxes	€0	€0	€0	€0	€0	€0	€3,844,630	€4,523,033
NET INCOME	-€56,902	-€204,052	-€187,415	-€253,406	-€453,242	€508,283	€16,083,506	€18,167,131

Source: Own elaboration using internal information and financial statements of the company

²⁷ For a deeper and more detailed explanation of this strategy, please see '5. How Codigames obtained an "extra life": the two key strategic changes followed by the company'.

²⁸ Note that in section '5. How Codigames obtained an "extra life": the two key strategic changes followed by the company' it is provided a timeline with full information about the games launched, its style, way to monetize, and results obtained by Codigames.

The good results and the share out of dividends allowed Francisco and Zacarías to repurchase shares from their partners. Therefore, at the end of 2019 both founders controlled again the majority stake in the company, and in 2020, the new dividends allowed Francisco to regain the 51% stake.

Table 4 Shareholders of Codigames 2013-2020

SHAREHOLDERS	2013	2014	2017	2019	2020
Francisco José Martínez	51%	26%	21%	44%	51%
Zacarías Gómez	49%	25%	20%	33%	38%
ANGELS	0%	22%	24%	20%	11%
BUSINESS ANGELS	0%	27%	23%	3%	0%
CAIXA CAPITAL RISC	0%	0%	6%	0%	0%
FARADAY	0%	0%	5%	0%	0%
	100%	100%	100%	100%	100%

Source: Own elaboration using internal information of the company

3. Characteristics of the managers vs environment: how to explain organizational change

The operation, competitiveness and survival of a company depends, to a large extent, on its ability to foresee, anticipate and respond to the pressures and changes present in the environment. To successfully overcome these circumstances and ensure the functionality of their companies, the managers, responsible for monitoring the evolution of environmental conditions, must be able (with that information) to adapt, modify or rethink their companies' competitive strategies to restore the desired business-environment alignment (in fact, according to Romanelli and Tushman, 1986, organizations that align well with its environment tend to have elevated business results). As a matter of fact, many times the indicator of the existing misalignment between the company and the environment are poor results, which are usually the trigger for the change process.

3.1 'Behavioral theory of the firm' and 'upper echelons theory': what triggers change?

This argument is heavily influenced by the 'behavioral theory of the firm' (Cyert & March 1963) which argues that an organization's managers will intend to pursue strategic changes when performance falls below a preset aspiration level (e.g., Greve, 2003, 2008). The underlying idea is that such 'attainment discrepancy' leads to dissatisfaction with the organization's results, which subsequently drives managers' intention to adapt the organization's current strategies in an effort to fix the problem ('problemistic search'; Shinkle, 2012). However, despite the dominance of this logic within performance feedback research, scholars have also developed complementary perspectives (Bowen et al., 2010). For instance, Jordan and Audia (2012) theorized that a failure to meet preset aspiration levels might not lead to a higher intention to change when managers still choose to assess their performance as satisfactory in an attempt to enhance their self-image. In contrast, Labianca et al. (2009) found that strong performers are sometimes eager to change the organization's current strategies if they proactively strive for even higher performance levels in the future.

These alternative perspectives indicate that strategic change is more complex (and therefore not only determined by a simple subtraction between performance and aspiration) than generally assumed by performance feedback scholars, and hence, they emphasize the need for studies that scrutinize these issues in more detail (Villagrasa et al., 2018).

A similar contradictory result is reached by the well-known '*upper echelons theory*' (Hambrick and Mason, 1984). This theory deeply highlights the importance of the study of managers, the most influential members of a firm and the responsible of the strategies and behaviors adopted by an organization. Consequently, this theory argues that if we want to explain why companies do the things they do, or why they act the way they do, we must study its managers jointly with its characteristics. Regrettably, the study of such characteristics similarly provides conflicting and inconclusive results, not clarifying the specific characteristics that would promote change and under which circumstances.

3.2 The introduction of the environment into the equation: a better understanding of change.

To solve this problem, literature proposes to include the effect of the environment in the equation. In fact, managerial decisions are always taken based on both internal and external resources and characteristics. The internal ones can be easily controlled and somehow pre-established by the firm. However, the forces of the environment, by definition, are not able to be set in advance by the company and, according to prior research, will have a very high potential role in these managerial actions (Goll and Rasheed, 2005). In this sense, it is important to highlight that the role of the external environment has been recognized from the very beginning by the '*upper echelons theory*' (and in an intrinsic way, as can be observed in its calculation, by the '*behavioral theory of the firm*'), although, however, the understanding and study of its effects is still limited (Cannella et al., 2009).

This situation is supported by Smart et al. (1984) which determine that the degree of entrepreneurial orientation (or intended change) is not only a function of the personality (or perception) of the manager, but also depends on the level of hostility present in the environment. Interestingly, delving into this aspect, Brockhaus (1987) found no statistical differences in general risk preferences (taken as characteristic of an entrepreneurial orientation) between groups of entrepreneurs/managers and population in general. And this argument is also supported by the study carried out by Peacock (1986) in which he found no significant differences in terms of propensity to take risks between entrepreneurs who had successful results and those who did not. Consequently, it seems that managerial characteristics, personality, perception, or preferences, are not responsible for the change produced in an organization (or at least, individually), but rather the environment would be the main culprit of it.

Next, we will show a couple of examples of this situation, where after adding the effect of the environment into the equation it seems that entrepreneurial change was finally predicted and understood properly. Thus, one example could be observed when analyzing the effect of homogeneity-heterogeneity of the management team on firm results, where contrary results were shown indistinctly by the literature. However, it seems that with the inclusion of the environment, in this case as a moderating variable, it was shed light to this tangle. Thus, we can affirm that managerial homogeneity generates better results in front of stable environments, while heterogeneity causes higher performance when companies operate in hostile environments (Hambrick and Mason, 1984). The underlying logic determines that in turbulent environments, the information processing demands on the management team increase (Bourgeois et al., 1988; Goll and Rasheed, 2005; Sanders and Carpenter, 1998), and the heterogeneity of the management team promotes a more rigorous strategic formulation process and with higher quality in its evaluations, therefore generating better results. Continuing with the moderating effects that would help to shed light to unresolved relationships, Keck (1997) finds that turbulence in the industry would positively moderate the

relationship between the diversity in the team tenure and the performance of the company. That is to say, the impact of the diversity in the team tenure in the business performance would be negative in stable (or less hostile) industries, but positive in turbulent ones. The explanation comes from the fact that diversity in the team tenure can be a proxy indicator of less social integration and team cohesion, which could be less necessary in turbulent contexts, since in these circumstances managers generally need to respond to changes and new situations in a more flexible and independent way. For its part, Goll and Rasheed (2005) determine that the munificence of the environment moderates the relationship between rationality in decision-making and the result obtained by the organization, so that the lower the munificence of the environment, the more positive the relationship between rationality and the result obtained. Another example of moderation is presented by Lin and Liu (2011), who propose that the effect of changes in the management team after a CEO succession process would have a more intense impact on the internationalization of the organization when operates in a more munificent environment.

4. Types of business response: Corporate entrepreneurship

Once we know that managerial characteristics, personality, perception, or preferences are not able to explain in isolation organizational change, we will actually deep into the potential strategic change processes that a firm may follow. In relation to this variety of possible firm responses, Covin and Miles (1999) delve into the concept of Corporate Entrepreneurship (CE) through which to define the different responses that a company can generate to obtain a competitive advantage that would allow it to compete effectively and improve its results. In this way, they define CE as *"the presence of innovation together with the presence of the objective of rejuvenating or the purpose of redefining organizations, markets or industries to create or maintain competitive superiority"* (Covin and Miles, 1999, p. 50). The four possible options envisioned by the authors are *'sustained regeneration'*, *'organizational rejuvenation'*, *'strategic renewal'*, and *'domain redefinition'*. It is important to mention that each of these options will be more or less appropriate for a company depending on its characteristics and needs, as well as the environment in which it is embedded.

It is worth mentioning that the typical frequency with which the four options occur will be related to the existing difficulty for them to happen. Thus, a high, moderate, low, and unlikely frequency will be established for *'sustained regeneration'*, *'organizational rejuvenation'*, *'strategic renewal'*, and *'domain redefinition'*, respectively. On the other hand, there will also be the possibility that these options fail and threaten the viability of the company. Thus, a low, low-moderate, moderate-high and high negative impact on the company will be established in the event of a possible failure of the actions to be carried out for *'sustained regeneration'*, *'organizational rejuvenation'*, *'strategic renewal'*, and *'domain redefinition'*, respectively.

Next, in addition to introducing these four options, we will relate them to the two main and key strategic changes followed by Codigames which definitely helped the firm to gain an "extra life" and continue to operate in the market: the switch to *'casual'* games and the application of a methodology that allows to reuse all the knowledge and technology developed in prior games (thanks to the replication of games within the same genre and driven their decisions on data and objective information). And we will do so, linking them with the aforementioned characteristics and needs of the firm, and even more importantly, with the specific environment where the firm was experiencing in each moment.

4.1 The four strategic CE options for change.

1. Sustained regeneration (highest frequency, lowest risk)

- It applies to companies that regularly and constantly introduce new products/services or enter into new markets through the use of valuable resources/skills they possess in order to exploit latent markets or markets which present opportunities (for instance, to sell the same product but in another country, or to improve the product portfolio in the same market that the firm operates). These companies will tend to be involved in wars for market share while trying to take advantage of product-market opportunities not observed or not appreciated by their competitors.
- In short, they will constantly be looking for a bigger presence in the market (through a bigger market share).
- This type of CE will be suitable for companies in mature or growing industries where product differentiation or market segmentation is associated with leading or better performing companies.

2. Organizational rejuvenation

- It applies to companies seeking to maintain or improve their competitive position by altering internal processes, structures, or capabilities within their pre-existing business strategy (some examples may be the reconfiguration of the value chain, the modification of the internal location of resources, the adoption of a new coding technology, or the incorporation of new administrative techniques).
- In brief, this type of CE would focus on the introduction of innovations that (a) redefine how certain critical aspects of the company's operations are carried out, (b) create value for customers, (c) maintain or improve the company's ability to effectively implement the chosen strategy.
- This type of CE will be suitable for companies that do not need high disruptive changes, that are strong in competition, but that need an improvement of the implementation of the current strategy.

3. Strategic renewal

- It is applied to companies that seek to redefine their relationship with competitors in their markets or industry, fundamentally altering the way they compete (for instance, the quality of the product offered, the price of the product sold, or the change in their position in the industry like IBM when changed from producing IT pieces to being a service and consulting company). Thus, while '*organizational rejuvenation*' focuses on the organization *per se*, '*strategic renewal*' focuses on the company and what surrounds it (such as the clients and the market).
- In short, it consists in the implementation of a "new and different" business strategy with which to redefine the way of competing both for companies that are leaders in the industry and want to maintain their competitive superiority, and for companies that want to improve their competitive position.
- This type of CE will be suitable for companies that need a strategic repositioning with which to improve their competitive positions.

4. Domain redefinition (lowest frequency, highest risk)

- It applies to companies that proactively create a new product-market field (at the same time) that others have not recognized or considered for exploitation. Thus, they will be in a better position to create a sustainable competitive advantage by being the first to make the move (“they will define where and how to play”). With this, it is possible to (a) avoid competitive confrontation in the current field, (b) move the competitive battle to a new field where current or potential competitors will probably be conditioned by their later entry.
- In summary, with this type of CE, the company is totally reoriented through the introduction of innovative products for the perspective of the company, the industry, and the market.
- This type of CE will be suitable for companies that find themselves competing in industries where the prospects for growth and profitability in a long term are uncertain.

5. How Codigames obtained an “extra life”: the two key strategic changes followed by the company

5.1 The 1st change: The switch to ‘casual’ games.

To understand this movement, we need to place ourselves in the position of the CEO and co-founder of Codigames, Francisco, and his company. As priorly mentioned, the firm received two investment rounds: the first one in 2014 of €345k, and the second one in 2016 of €800k. However, the sales and results of the firm did not show an immediate and clear correlation with this investment (i.e., in the years after the investment, the firm did not show a proportional increase of sales and results). For a better follow-up, below we provide a table with all the information of the sales, results and investment received from 2013 (when the firm was founded) to 2020. Likewise, in this table it is also included information about the cash hold by the firm per year, as well as the number of employees, the profitability ratio (results/sales), the sales/employee ratio, and the results/employee ratio (see Table 5).

Table 5 Key financial information and ratios of Codigames (2013-2020)

	2013	2014	2015	2016	2017	2018	2019	2020
Sales	€10,900	€224,000	€512,000	€977,000	€614,000	€1,600,000	€44,300,000	€71,800,000
Results	-€56,000	-€204,000	-€187,000	-€253,000	-€453,000	€508,000	€16,100,000	€18,100,000
Profitability (results/sales)	-	-	-	-	-	32%	36%	25%
Cash	€29,000	€269,000	€74,000	€500,000	€76,000	€183,000	€10,500,000	€5,700,000
Nº employees	7	12	14	21	22	17	27	55
Sales/employee	€1,500	€18,600	€36,500	€46,500	€27,900	€94,000	€1,640,000	€1,305,000
Results/employee	-	-	-	-	-	€298,000	€596,000	€329,000
Investment received	-	€345,000	-	€800,000	-	-	-	-

*note that round figures have been applied in every item

Source: Own elaboration using internal information and financial statements of the company

As can be observed, the firm only started to be profitable since 2018. For its part, the year 2017 was the toughest year for Codigames, with the worst results in its history (almost -€500k) and a really low cash to operate gaily and without restrictions (with only €76k). With these results, and just one year after its second investment round of 2016, the company was starting to be questioned by its shareholders and suffering potential real bankruptcy problems. Thus, on one side, two of its investors: Caixa Capital Risc (6%) and Faraday (5%), started to put on the table their intentions to sell the whole company to another firm given the poor results obtained after five years of operation in the market (from 2013 to 2017). On the

other side, the main investors: Angels (24%) and Business angels (23%) showed a controlling and worried attitude towards the firm, meeting with the company weekly to check the progress of the jointly agreed activities, proposing solutions such as the reduction of the staff to get the company afloat, or suggesting to the firm that it eventually release one ‘casual’ game within its portfolio (something that Francisco had considered as the panacea/outlet for the company in its business plan and meetings since this second investment round in 2016).

Two potential outlets: To reduce the workers or reconsider the strategy to compete in the market

Francisco was totally against a reduction in the staff of the company (following in this case the same type of strategy of ‘midcore’ genre), which would mean the return of the company to its first years of existence and a betrayal of the workers and investors who bet on their project (for more information see ‘4. How ambidexterity may help to be a leader’).

Therefore, the only way out remaining was to work on and launch its first ‘casual’ game since the firm was placed in Marina de Empresas (note that in reality, in 2012 when the firm was not even established legally as a corporation, it launched two ‘casual’ games: ‘The Mordis’ and ‘Cross the Line’, with very poor results; likewise, in 2013, the first year of the company in Marina de Empresas, it also launched another two ‘casual’ games: ‘Infinity Space’ and ‘King of Party’, however, its results were also that poor –with no more than €50k in the first case, and with the withdrawal in the second– that the company did not work in that genre again), something with which Francisco was not entirely sure, since the company had focused and made all its efforts on ‘midcore’ games since 2014. The name of such ‘casual’ game was ‘Super Idle Cat’ (which specifically was launched in July, 2018) and obtained more than €200k (note that the firm only had improved this figure three times since it was created, with ‘Empires of Sand’ in 2014 with more than €500k; with ‘Dungeon Legends’ in 2015 with more than €1mn; and with ‘Lords&Castles’ in 2016 with more than €500k – all of them, as already mentioned, belonged to the ‘midcore’ genre, where the company was placed comfortably until 2017 –included–) (for a comprehensive list of the games launched, its style, way to monetize and results, please see Table 6 below).

Success dispelled doubts immediately, and in the exact same year 2018, the firm launched three more games within the same ‘casual’ genre: ‘Idle Cooking Tycoon’ with more than €500k; ‘Idle Airport Tycoon’ the first game with more than €2mn; and ‘Idle Harbor Tycoon’ which unfortunately was withdrawn due to its poor results. Moreover, due to the great success of this genre, the strategy was replicated by releasing only ‘casual’ games in both 2019 and 2020, reaching more than €20mn in four of them: ‘Idle Supermarket Tycoon’ (the first game which reached these figures and, as previously mentioned before, a game that was based on the same core business of its main investor Juan Roig: a supermarket), ‘Idle Theme Park’, ‘Hotel Empire Tycoon’, and ‘Prison Empire Tycoon’. The miracle had been obtained, and the magic recipe to understand the type of games that the market appreciated seemed to work.

Table 6 Comprehensive list of games launched, its style, way to monetize and results (2012-2020)

RELEASE	GAME	TYPE OF GAME (STYLE OF THE GAME)	MONETIZATION	PERFORMANCE*	NOTES**
1	2012 The Mordis	Casual - Puzzle	Buy to play	Low	Amateur learning phase - FIRST casual game (however note that the firm was in its initial stage)
2	2012 Cross The Line	Casual - Puzzle	Buy to play	Low	Amateur learning phase
3	2013 Infinity Space	Casual - Runner	Free to play	Good	FIRST project with >€50k - The company is founded in this year
4	2013 King of Party	Casual - Social Multiplayer Real Time	Free to play	Bad	Removed
5	2014 Empires of Sand	Midcore - Strategy Builder Multiplayer Real Time	Free to play	Very good	FIRST project >€500k
6	2015 School of Magic	Midcore - Builder Multiplayer Real Time (Role Playing Game)	Free to play	Low	FIRST role playing game
7	2015 Dungeon Legends	Midcore - Multiplayer Real Time (Role Playing Game)	Free to play	Very good	FIRST project >€1m
8	2016 Lords & Castles	Midcore - Strategy Builder Multiplayer Async	Free to play	Normal	Project with >€500k
9	2017 Zombie Faction	Midcore - Strategy Multiplayer Async	Free to play	Low	2017 was the year with the most losses in the firm
10	2017 Heroe of Rings	Midcore - (Role Playing Game)	Free to play	Low	2017 was the year with the most losses in the firm
11	2018 Battle Royale Ultimate Show	Midcore - Battle Royale Shooter Multiplayer Real Time	Free to play	Bad	Removed
12	2018 Zombie Battleground	Midcore - Strategy Multiplayer Real Time	Free to play	Bad	Removed
13	2018 Super Idle Cat	Casual - Idle Tycoon	Free to play	Low	FIRST casual game with more >€200k - FIRST casual game with the firm in 'Marina de Empresas'
14	2018 Puzzle Fantasy Battles	Midcore - Puzzle (Role Playing Game)	Free to play	Bad	Removed
15	2018 Idle Cooking Tycoon	Casual - Idle Tycoon	Free to play	Normal	Project with >€500k
16	2018 Idle Airport Tycoon	Casual - Idle Tycoon Simulation	Free to play	Very good	FIRST project with >€2m
17	2018 Idle Harbor Tycoon	Casual - Idle Tycoon	Free to play	Bad	Removed
18	2019 Merge Food Truck	Casual - Idle Merge Tycoon	Free to play	Bad	Removed
19	2019 Idle Supermarket Tycoon	Casual - Idle Tycoon Simulation	Free to play	Very good	FIRST project with >€20m
20	2019 Idle Restaurant Tycoon	Casual - Idle Tycoon Simulation	Free to play	Bad	Removed
21	2019 Idle Theme Park	Casual - Idle Tycoon Simulation	Free to play	Very good	Project with >€20m
22	2019 Idle Fitness Gym	Casual - Idle Tycoon Simulation	Free to play	Normal	Project with >€5m
23	2020 Hotel Empire Tycoon	Casual - Idle Tycoon Simulation	Free to play	Very good	Project with >€20m
24	2020 Idle Life Sim	Casual - Idle Life Simulation	Free to play	Normal	Project with >€5m
25	2020 Prison Empire Tycoon	Casual - Idle Tycoon Simulation	Free to play	Very good	Project with >€20m
26	2020 Idle Police Tycoon	Casual - Idle Tycoon Simulation	Free to play	Normal	Project with >€5m
27	2020 TV Empire Tycoon	Casual - Idle Tycoon Simulation	Free to play	Low	Project with >€3m

*Performance - It is important to clarify that the results are related with the situation/magnitude of the specific moment of time (Scale: Bad - Low - Normal - Good - Very good)

**Notes - This information was updated by the CEO of the firm Francisco José Martínez at the beginning of 2022

Source: Own elaboration using internal information of the company

Type of CE option followed in the 1st change: 'Strategic renewal'

As priorly mentioned, in 2017 the company was experiencing a really hostile environment, bringing the business closer to sale or closure. This type of environment is normally characterized by a relative scarcity of resources, whether they are factors of production, financial resources, technological resources, bureaucratic, economic, political, legal, and/or social (Wan and Hoskisson, 2003), which increases the risk of continuing in those markets

(Keats and Hitt, 1988) because the strategic options to be implemented are reduced (Castrogiovanni, 1991), so that *"although opportunities still exist, they are more difficult to identify and exploit"* (Castrogiovanni, 1991, p.552). Consequently, in general, companies obtain worse results when facing low-munificence environments, which in turn can sharpen/force the strategic vision of companies when adjusting their strategies and structures in order to survive (Haveman, 1992; Wan and Hoskisson, 2003).

And this is exactly what happened to Codigames, which wanted (or needed) to radically redefine the way of competing in the industry with the aim of improving its position and surviving, in a sort of *'strategic renewal'* following Covin and Miles' (1999) nomenclature (in fact, if we remember the characteristics of this type of strategic change, we will notice that it is not applied frequently by firms and that may potentially generate a negative impact to the firm, even provoking its closure). In particular, this change was implemented by Codigames through a radical reposition from the classic vision of 'author games' (*'hardcore'* or *'midcore'* style) where the company was competing for four years (2014-2017), towards a more general and democratized vision of gaming (*'casual'* style), therefore reaching the great mass of players (and market) who usually look for more collaborative, social and mobile games (vs the ones related to a game console interface). It is important to highlight that normally, and as mentioned before, these types of games are quite easy to handle and understand, presenting a similar gameplay which, not only extends the life cycle of the games, but also improves the bond and money expended by the user. Finally, it is worth mentioning, that the organization, with the aim of repositioning not only its business but its whole company, it also changed its logo from a more classic and formal style, to a more casual and carefree one (like its types of games).



Figure 1 Evolution of Codigames logo (2013-2017)
 Source: Obtained through the company business plan

5.2 The 2nd change: The application of a methodology that allows to reuse all the knowledge and technology developed in prior games.

This movement can be understood as a consequence of the shift from the *'midcore'* style to the *'casual'* one. However, to better comprehend this second change we should analyze two perspectives: the one from the user and the one from the firm, the two main actors "affected" by this action.

Perspective of the user

As mentioned in the first change ('The switch to *'casual'* games'), due to the great success of the *'casual'* genre in the firm in 2018 (with *'Super Idle Cat'* with more than €200k, *'Idle Cooking Tycoon'* with more than €500k, and *'Idle Airport Tycoon'* with more than €2mn), in 2019 and 2020 the company only launched *'casual'* games, reaching in four of them more than €20mn (*'Idle Supermarket Tycoon'*, *'Idle Theme Park'*, *'Hotel Empire Tycoon'*, and *'Prison Empire Tycoon'*). These results confirm the success of this type of genre in the market, which besides being focused on a wider population, they are also easier to handle and understand by the user, presenting a similar gameplay that can be easily remembered and liked by them (facilitating that they become potential new players of more games, increasing its bond and money expended).

Perspective of Codigames

From the point of view of Codigames, launching similar games with similar gameplay/functionality facilitates the reuse of all the knowledge and technology previously developed in prior games, which therefore speeds up the process and reduces the firm costs. Besides, in this case where the firm seems to have found the magic recipe to meet the needs of its clients, this also means obtaining good revenues in more games. Thus, for instance, after switching to *'casual'* games in 2018 and developing "only" one game with more than €2mn (*'Idle Airport Tycoon'*), in 2019 the firm developed two games with more than €20mn and one with more than €5mn (*'Idle Supermarket Tycoon'* and *'Idle Theme Park'*; and *'Idle Fitness Gym'* respectively), while in 2020 developed two more games with more than €20mn, two with more than €5mn and one with more than €3mn (*'Hotel Empire Tycoon'* and *'Prison Empire Tycoon'*; *'Idle Life Slim'* and *'Idle Police Tycoon'*; and *'TV Empire Tycoon'* respectively).

As mentioned before, Codigames is structured in individual cells which independently follow four stages: *'selection'*, *'prototype'*, *'development'*, and *'maintenance'*. Nothing new. And it is that other video game firms also work in a similar way. However, Codigames' competitive advantage seems to be its speed and quality, which achieves to meet pretty well the needs of its clients, attracted by its similar functionality and easiness of gaming (similar to other games that they enjoyed playing before). In fact, according to Francisco:

"Codigames has achieved to be like Marvel, obtaining that magic, epic, and engagement in its games as Marvel does in its movies. Thus, the firm is now able to easily replicate great

hits, obtaining games valued by clients and that are extremely profitable. Similar to what Marvel does in its movies using different and new superheroes that captivate the spectators. To do so, Codigames uses a lot of game metrics and analytics to see what works and what does not. What likes the client and what does not. If it works, the firm leaves it like it is, and if not, it changes it until it makes it function. For that, Codigames makes games that are structured in individual parts and therefore can work on them individually to finally obtain the desired output. And this is the secret of the success: to reuse many of these parts in the forthcoming games. Consequently, taking advantage of the learnt development, innovation, and technology. Creating similar games that apparently seem individual pieces. This is the competitive advantage of Codigames. This is why Codigames is so profitable. This is why it achieves it with so few workers. And this is why it achieves it so fast. In no more than six months and with really high standards. Each studio has its own strategy, taking more or less time to do the soft-launch and the global release depending on the quality they want to allocate in each phase. Because, there will be studios with lots of money, however to be able to create games so fast and with a high quality, a quality that works and is appreciated by the player, this is so fucked up. And this is what makes us different, unique, and valuable. This is what makes us Codigames". (F. Martínez, personal communication, 17th March, 2020).

Type of CE option followed in the 2nd change: 'Organizational rejuvenation'

In this case, once Codigames realized that it could be profitable and successful by competing within the 'casual' genre, it began to think about how to maintain its competitive position in the industry for a long time. To do so, the firm started to focus and look internally on its processes with the aim of enhancing and keeping its competitive advantage, in a sort of 'organizational rejuvenation' following Covin and Miles' (1999) nomenclature (in fact, if we remember the characteristics of this type of strategic change, we will notice that it can be applied with more frequency than the prior strategy –in fact, this option would try to improve and make more efficient a current implemented strategy–, and that is why it is less dangerous for the potential negative results obtained by the firm). In particular, as mentioned before, this change was implemented by Codigames through the application of a similar methodology in its games. Thus, the firm could reuse all the knowledge and technology developed in prior games, replicating the success of the best games created through a simple copy-and-paste strategy, using for it, a great analytical and metric component.

5.3 Two key strategic changes to beat the game and become a profitable firm.

Consequently, these two strategic changes helped Codigames to gain an "extra life", to continue operating in the market and thus, avoiding its disappearance; but also becoming a profitable and respected company in its sector, with earnings of €16mn (2019) and €18mn (2020), and a profitability of 36% (2019) and 25% (2020) (note that 2019 and 2020 were the years in which the firm decided to modify its strategy) (for more complete information, see Table 5).

6. How ambidexterity may help to be a leader

Ambidexterity at the managerial level focuses on the crucial role of managers' knowledge, skills, and behaviors to address opposed demands and promote organizational ambidexterity (Mom et al., 2019), understood as the ability to be efficient in the management of today's business (exploiting it) while also adaptable for coping with tomorrow's changing demand (exploring it). As such, to successfully complete their assigned duties, managers need to

employ the appropriate interpersonal style and calibrate their behavior to different contextual demands (Kapoutsis et al., 2019). And this is exactly what Francisco did since he started to be part of Marina de Empresas (and founded his company), dealing properly and smoothly with the people above him such as investors and managers of the institution of Marina de Empresas, likewise talking its language of numbers and finance (more exploitative); but also with the people below him such as workers and team, talking also its language about their work conditions, evolution of their position in the company, etc. (more explorative). In fact, Francisco was very ambidextrous, being good technically or with the hard skills (creating games and understanding the complexity of the business) but also with the soft skills (being able to motivate workers and make them believe in his project). And this, in words of the CEO of Angels Pepe Peris, the investment vehicle of Marina de Empresas, *“was a key success factor for the project, and what made Francisco to be a good leader for the firm”* (P. Peris, personal communication, 16th July, 2021).

To be a leader

This leadership according to Pepe Peris, has been showed by Francisco many times during these seven years (P. Peris, personal communication, 16th July, 2021):

- Thus, for instance, Francisco stated since the first investment round in 2014 that his company was going to launch a game that was going to be #top 3 in the world (something that as previously mentioned was not reached until April, 2019 with *‘Idle Supermarket Tycoon’* which was #top1 in downloads in the US market).

Similarly, in the second investment round of 2016 he argued that the company should turn into the *‘casual’* genre to be profitable, as a sort of panacea/outlet for the company that was suffering and experiencing critical financial problems. It is important to remember that Francisco was not entirely sure about this movement, since the company had focused and made all its efforts on *‘midcore’* games since 2014 and that is why Codigames does not launch its first *‘casual’* game after 2014 until July, 2018: *‘Super Idle Cat’*, when he did not have any other option due to the bad results and the lack of support of its shareholders. Nevertheless, in this moment Francisco was stating that with this game the firm would make €100k/month and would finally be successful. Unfortunately, as we know, this result was not obtained. However, *‘Super Idle Cat’* was the first *‘casual’* game of the firm with more than €200k and the turning point for the firm.

Therefore, as can be observed, Francisco was acting totally as a leader of the firm, using in this case its soft skills to convince, believe, and engage the workers and investors with its project.

- In a second place, Francisco showed another sign of his leadership, in this case also related to its soft skills, when potentially thought about moving from the facilities of Marina de Empresas to their own facilities. In this case, he could have thought about any building in the city that he liked (and suited with its needs and demands) with lowest price of the squared meter. However, he asked the address of every single worker of the firm in terms of calculating the shortest average distance among the different potential options.
- In a third place, Francisco showed its leadership, in this case related to its hard skills, in 2018, the year after the firm suffered those important financial problems (in 2017): with the worst results in its history (almost -€500k) and a really low cash to operate without restrictions (with only €76k). Thus, in 2018, despite the results are almost +€500k and the cash +€180k at the end of the year, it was not until the firm launched *‘Super Idle Cat’* in July when the firm started to take off. In fact, in the eight first months its income and

expenses were quite similar and around €50k (wages: €35k and other costs: €15k). And at that tough time, the main shareholders Angels (24%) and Business angels (23%) proposed as one of the possible solutions of the bad results of the firm, a radical reduction of its staff in order to get the company afloat, dismissing 8 workers of a total of 17. However, Francisco argued that this was not an option as technically, with a low number of workers (9), and specifically with less than ten, it would be impossible to make the firm scalable and profitable, condemning it to failure. In fact, having around 8-9 workers per cell and taking on average six months to launch a game, this would mean to only releasing two new games a year, something that the firm was doing until 2017 (with a similar number of workers, and with the result of poor outcomes).

- In the last place, Francisco showed its leadership, in this case related to its soft skills, in the document of HR internal policies and pay scale which is available for all the workers of the firm. There, it is shown the big effort and empathy of Francisco with the entrepreneurial project but also, and implicitly, with the own vital project of every worker. In the document it is shown the different salary levels for all the type of workers of the firm: A) product workers (programmers, artists, and game designers), B) marketing workers, and C) support workers. However, the information for managers is empty. Instead, there is a story of overcoming and effort that suggests how difficult was for him to create the firm by investing all his savings, by not obtaining any (financial, technical, HR) support at first, by losing many entrepreneurial contests, by almost bankrupting the firm a couple of times, but also how important was to overcome these situations, to welcome some help to develop the company and make it grow, and to wear “(clean) superman underpants” to keep on dreaming each morning.

Ambidexterity and results

Literature widely supports the influence of ambidexterity on higher levels and less variation in managers’ task performance compared to the sole use of either hard or soft tactics (Kapoutsis et al., 2019). Interestingly, the results of Codigames prove these arguments, with earnings of €16mn (2019) and €18mn (2020), and a profitability of 36% (2019) and 25% (2020) (for more information, see Table 5).

7. Potential subsequent questions of this case study

- How many games did Codigames launch in 2021? Were they ‘casual’ games?
- Did Codigames performed any other strategic change in 2021?
- Did Codigames improved its sales and results in 2021? How much? How was the profitability?
- Did Codigames moved into its own facilities in 2021 or stayed in the ones of Marina de Empresas?
- Do you think Codigames allows to telework? Do you think is it something that Codigames wants? Or does it prefer they workers to work in the same space?
- In April 2021, Apple made a game changer move. From that moment on, owners of their iPhones all over the world would be seeing in-app prompts asking if they were OK being “tracked”. Then, if the users clicked “Ask App Not to Track” they would deprive developers from seeing their IDFA. How do you think that users are going to react? How would this affect the mobile advertising industry?

8. Conclusions

In 2021 there were 4.6bn active smartphones in the world. Among them, 703.5mn were 5G-ready (15%), what embodied an impressive year-on-year growth of 230.9%. The projections are equally spectacular given that by 2024 it is forecasted that there will be 5.3bn of active smartphones, where a total of 2.4bn would be 5G-ready (45%) (Newzoo, 2021). Consequently, this situation has boosted the mobile game market, making it bigger and bigger each year, holding an estimated global number of players of 3bn (out of 5.3bn of active smartphones, which leads to a remarkable 56%) in 2021 and a not at all insignificant figure of \$90.7bn in revenues (Statista, 2021). For its part, Spain is a small but growing market where there were 655 active studios at the end of 2020 (White Paper on Spanish Video Game Development, 2020). Among them 66% were young companies (between 2 and 10 years old) and 61% had a pretty small turnover (below €200k per year). In fact, in the whole country, only 4% of studios have a considerable business volume of more than €10mn. In this understudied (and partially underdeveloped) Spanish context, we have limited knowledge of how certainly are the successful and unsuccessful strategies implemented by the studios, its work methodology applied, how they organize themselves internally, its type of clients, and even, the aspects that may act as leverages of change in its business direction.

Hence, this paper shows in depth the creation from its origins of a very profitable Spanish video game studio, which went from obtaining negative results (during five years) to billing more than €70mn in just seven years, as well as its hard and bumpy road until reaching such business success.

The paper describes this achievement as the combination of many factors such as 1) the opportunity of being accelerated in a determined entrepreneurial ecosystem (Marina de Empresas, a unique consolidated business ecosystem placed in Valencia, Spain, and formed by a business school, a start-up accelerator, and an investment vehicle gathered in what has become as one of the most important and vibrant entrepreneurial hubs of the Mediterranean area), 2) the way the firm organizes its work internally (with individual cells of 8-9 workers lead by a product manager or leader of the cell, which work independently from other cells in different projects developed by the company), 3) its technology applied (where several games, that apparently seem individual pieces, are developed at the same time, reusing the technological development and players' know-how gained in previous projects to, therefore, generate quick and quality launches), 4) its methodology used to create the games (with four differentiated stages: A. '*selection*' of the idea/game among different proposals; B. design of a '*prototype*', where after 2-3months of work the firm develops a soft-launch of the game to some specific players who will act as testers and will help to improve it; C. '*development*' of the game with all these inputs for 2-3 months more, where finally the game is launched worldwide; and D. '*maintenance*' of the game, where another different team made up of around 8-10 people and which work transversally in all the portfolio of games released by the firm, will focus on launching upgrades, adding new contents, and correcting errors, with the objective of extending the life cycle of the game), 5) the social or collaborative aspect of its games (in fact, the selection of this category of games was key for the firm because it meant that players could communicate and play together, competing or cooperating among them, what eventually created a sense of community that in the end, helped to keep players coming back to their current and future games, generating a longer life cycle than individual or single-player games, where the contribution from only one player is expected), 6) the '*idle*' genre selected (which due to its characteristics –based on a compulsory evolution achieved within

the game despite the initial understanding of it or the number of hours played—, similarly increasing the engagement and interest for the game, and therefore, its retention and potential monetization), 7) its way of monetizing (through a F2P business model, a figure which became popular during the last years due to its advantage to avoid piracy by skipping the download of the game, but that due to the particular social characteristic of its games, where a large mass of players was needed to encourage even more players to join the game, was perfectly suitable for scaling-up the business), and 8) and the particular ambidextrous characteristics of its CEO (that allowed him to deal properly with the people above him, such as investors and supporters, talking its language of numbers, technical execution of games, and finance –i.e., being more exploitative–; but also with the people below him, such as workers and team members, talking also its language, understanding its needs, motivating them, and making them to believe in his project –i.e., being more explorative–).

In this way, all these characteristics and circumstances made possible to turn the worrying course of the company, which went through two financial rounds (the first one in 2014 of €345k, and the second one in 2016 of €800k), experienced moments of real possible technical bankruptcy (especially in the year 2017 with the worst results in the firm's history, almost -€500k, and a really low cash to operate gaily and without restrictions, with only €76k), and obtained propositions of radical reductions of its staff (as proposed by its shareholders in 2018, putting on the table the dismissal of 8 workers of a total of 17, leading the company to a situation similar to the one it had at its inception in 2013), into a profitable and promising project. In fact, the firm obtained earnings of €16mn and €18mn in 2019 and 2020, and a respectively profitability of 36% and 25% in both years; obtained an average lifetime value per user of €7.5, around three times the average of the industry; and maybe the most important aspect, has been able to discover the magic recipe to understand the type of games appreciated by its users and market, thus, for instance, after eventually switching to 'casual' games in 2018 and developing "only" one game with more than €2mn ('Idle Airport Tycoon') in that year, in 2019 and 2020 the firm was able to develop four games with more than €20mn of revenues ('Idle Supermarket Tycoon', 'Idle Theme Park', 'Hotel Empire Tycoon', and 'Prison Empire Tycoon'), therefore replicating its success.

And this seems to have been the game-changer of Codigames, who was able to shift its strategy on time, moving from a 'hardcore' style where the company started to compete in the first moment, towards a more general, popular and democratized vision of gaming, what is known as 'casual' games, therefore reaching the great mass of players who usually look for more collaborative, social and easy to handle games, which present a similar gameplay and extends the life cycle of the games and its potential bond, engagement, retention and potential future monetization. In fact, the paper similarly suggests that this strategical change, which definitely helped the firm to gain an "extra life" and continue to operate in the market, was not simply generated by the inner characteristics, personality, perception, or preferences of the managers of the firm (as the 'behavioral theory of the firm' or the 'upper echelons theory' determines, though as we know, showing some contradictory results), but due to the environment that the company experienced at that time (i.e., following the 'Corporate Entrepreneurship theory'). In fact, this environment helped the firm to carefully define the strategic response to undertake at each point, taking into account the four possible options ('sustained regeneration', 'organizational rejuvenation', 'strategic renewal', and 'domain redefinition'), but also its appropriateness with the needs and characteristics of the firm, its facility of implementation (or frequency) and its potential effects (or threat of fail) on the firm to keep on being competitive and survive.

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**Accounting
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PROFESSIONAL PAPERS

TAXATION OF TRANSPORT SERVICES WITH VAT

Luka Mladineo

University Department for Professional Studies, Split, Croatia
lmladine@oss.unist.hr

Monika Jukić-Bračulj

University Department for Professional Studies, Split, Croatia,
monikajukicbraculj98@gmail.com

Abstract. In today's globalized world, where the consumer mentality leads to economic growth worldwide, transport services are the ones that represent significant opportunities or obstacles for further development. This was best seen when the disruption in transport services in these times of crisis led to further delays in the production of certain products and even shortages of certain products. With regard to the above mentioned, it is clear how important transport services are, so their treatment within the tax system is a very interesting topic, especially within the value added tax system. In the first part of this paper transport services will be defined. Once different types of transport services have been defined, they will be treated within the value added tax system as a general sales tax. In this paper, special attention will be paid to the treatment of freight transport and passenger transport. The primary goal of this paper is to show the differences in value added taxation of transport of goods and passengers in both the Republic of Croatia and EU member states, as well as third countries that are not members of the European Union. The paper will also present the differences in value added taxation when services are provided between two taxpayers, but also in the case when they take place between a taxpayer and the final consumer.

Key words: *transport of goods, transport of services, value added tax, taxpayer*

1. Introduction

The issues that need to be identified in this paper with the aim of explaining the taxation of transport services are:

- Definition of transport,
- Type of transport services,
- Transport documentation,
- Issuing invoices,
- Definition and VAT payers,
- The amount of the tax rate,
- VAT payment.

The aim of this paper is to define transport services and what they include as well as how they are taxed with value added tax according to Croatian regulations.

Legislation will be analysed in order to determine the procedures for calculating value added tax for transport services within the Republic of Croatia, the European Union and third countries.

2. Transport services

Transport services are an economic activity that deals with the transportation of people and goods from one place to another.

Transportation services can be provided by land, air and water.

Transport services can be performed by natural and legal persons who are registered, technically and personnel equipped for different types of transport. In the Republic of Croatia there are a number of companies and crafts that provide transport services for persons and goods both in the country and abroad.

In addition to transport services related to the transport of various goods in the Republic of Croatia, as well as in the European Community, passenger transport services are becoming more widespread, of which (Official Gazette number 41/18 i 98/19):

- Local regular transport,
- International regular transport,
- Transit transport,
- Taxi transport,
- Shuttle transport, etc.

Value added tax

Value added tax is paid on the delivery of the transfer of the right to dispose of tangible assets.

Activities related to transport that are subject to value added tax are:

- Telecommunication services,
 - Supply of water, gas, electricity and heating,
 - Transport of goods,
 - Port services,
 - Airport services,
 - Passenger transport,
 - Delivery of new goods produced for sale
- and similar services defined by the Value Added Tax Act.

Value added tax

A taxpayer is any person, whether natural or legal, who independently carries out any activity in the economy. (Official Gazette 73/13, 99/13, 148/13, 153/13, 143/14, 115/16, 106/18 i 121/19.)

Goods that are not shipped or transported are taxed at the place where they are at the time of delivery. With regard to the delivery of goods by ship, train or aircraft, the place of delivery shall be deemed to be the beginning of the carriage.

The place of performance of the service to the taxpayer is its seat.

The place of supply of passenger transport services is the place where the transport is performed in proportion to the kilometres travelled, while the transport of goods within the European Union is the transport where the place of origin and end of transport are in the two Member States Markota Lj. Et al., (2015).

The basis for tax calculation is the fee that the supplier has received or should receive for delivery from the customer or user of the service. The tax base includes the amounts of taxes, customs and similar duties, except VAT, and other costs such as commissions, packaging, transport and insurance costs charged by the supplier of goods or services to the buyer.

The tax base does not include price reductions and discounts due to early payment.

In cases where the elements for calculating the tax base are expressed in foreign currency, the exchange rate is determined in accordance with European Union regulations governing the determination of customs value.

Bilen (2015) notes in his paper that the VAT Act applies to any form of passenger transport, regardless of the means by which the transport is performed, regardless of whether the provider or recipient of passenger transport services is based in Croatia or elsewhere and whether the user services obligor or not, which includes the transport of passengers at home and abroad.

Value added tax (VAT) is calculated at the rate in force at the time of the taxable event. For most transport services, the tax rate in the Republic of Croatia is 25%.

3. Taxation of transport services

The transport of goods or the performance of services in the Republic of Croatia is taxed in the same way as any other service in the country, because both the recipient and the executor of the service, as well as the road section were performed in Croatia. In that case, the taxpayer charges 25% tax on the tax base (fee for transport service) Markota Lj. (2013).

In the case of transport that has elements of foreignness, the provisions on the place of preformed services are important because the transport is performed on a section of road in Croatia but also in other Member States and third countries.

A carrier from the Republic of Croatia who performs the transport service for a taxpayer from another Member State must present the value of the delivery through the VAT form in such a way that:

- show non-taxable deliveries - services performed within the European Union and
- show individual recipients of services to which the tax liability has been transferred (collective application)

With the collective application, the taxpayer in the Republic of Croatia informs the competent Tax Administration about taxpayers who have not calculated VAT, ie about movements of goods to other Member States and about providing services to taxpayers from other Member States.

It is important to mention that the member states of the European Union are obliged to provide data via the information network to other member states. This procedure informs the states about the values of deliveries that should have been reported, but also the tax liabilities of the respective taxpayers.

In general, transport services are taxed according to the section of road where the transport takes place and not according to the seat of the service provider (general principle). If the transport service is not performed only in the home country, then only the part of the service that is being performed in homeland will be charged.

If the user of services is a value added tax payer, the paid VAT represents a pre-tax which will be shown through the tax return and reduce his tax liability.

Transport services are taxable in cases when they relate to passenger transport and the transport of imported goods.

4.1. Rules for the taxation of transport services between two or more EU Member States

Intra-Community transport of goods' shall mean any transport of goods in respect of which the place of departure and the place of arrival are situated within the territories of two different Member States.

'Place of departure' shall mean the place where transport of the goods actually begins, irrespective of distances covered in order to reach the place where the goods are located.

'Place of arrival' shall mean the place where transport of the goods actually ends. (Council Directive 2006/Article 48).

The method of taxation, apart from the type of transport in question, depends, among other things, on who we provide the transport service to. Whether the transport service is performed between all B2B taxpayers (tax rules in Table 1) or the transport service is performed by the taxpayer B2C end user (tax rules in Table 2)

Table 1 Taxation of B2B transport services

Type of transport	Taxation rule
Intra-EU transport of goods	in the country of the recipient of the service (customer)
Goods transport services outside the EU	in the country of the recipient of the service (customer)
Passenger transport services	according to the road section

Source: author's work according to the Law on VAT

Therefore, if the transport of goods is performed by a taxpayer from another Member State or a third country for a taxpayer in the Republic of Croatia, then regardless of the route, the Croatian taxpayer calculates VAT on the basis of the received invoice and displays it through the VAT form and has the right to deduct. In such a VAT return, the basis on which the VAT was charged is stated, as well as the VAT identification number of the taxpayer who issued the relevant invoice.

If the transport service is performed only partially through the Republic of Croatia, then the invoice will show VAT for the value of the service related to the road section in Croatia.

It is the same in the case of a taxpayer from the Republic of Croatia performing a transport service within the European Union for a taxpayer from another country that is also a member and then the general principle of taxation also applies, according to which the place of service is considered the seat of the user.

In the case of a passenger transport service between two taxpayers, then in accordance with the general principle, VAT on passenger transport services within the

European Union is taxed according to the section of road in each Member State, in proportion to the kilometres travelled.

Table 2 Taxation of B2C transport services

Type of transport	Taxation rule
Intra-EU transport of goods	In the country of start of transport
Goods transport services outside the EU	according to the road section
Passenger transport services	according to the road section

Source: author's work according to the Law on VAT

When a taxable person from the Republic of Croatia performs a transport service within the European Union for someone who does not have a VIES number and is not a taxpayer from another member state, the general principle of taxation applies according to which the place of the service is a Member State in which the transport of goods began.

If a taxpayer from the Republic of Croatia performs the service of transporting goods for someone who does not have a VIES number and is not a taxpayer outside the European Union, then in accordance with the principle it is taxed according to the road section in each Member State.

When providing a passenger transport service between a taxpayer and a non-taxable person in accordance with the general principle, VAT on passenger transport services within the European Union is taxed according to the road section in each Member State, in proportion to the kilometres travelled.

4. Valued added tax rate on transport services in EU

Taxation of international passenger transport is an area that leads to a number of tax exemptions in some EU Member States.

Otavová and Sobotková (2012) are on the example of the Czech Republic, Slovakia, Poland, Austria and Germany that the conditions of taxation are different as well as entities that pays taxes in each of the countries.

Table 3 shows the VAT rates that tax transport services in individual EU member states.

Table 3 Valued added tax rate for transport services

MEMBER STATE	DOMESTIC ROAD TRANSPORT	INTRA-EU TRANSPORT	EXTRA-EU TRANSPORT
AUSTRIA	REDUCED 10%	REDUCED 10%	REDUCED 10%
BELGIUM	REDUCED 6%	REDUCED 6%	REDUCED 6%
BULGARIA	20%	0%	0%
CROATIA	25%	25%	25%

CYPRUS	19%REDUCED 9% / 5%	0%	0%
CZECH REPUBLIC	21REDUCED 15%	0%	0%
DENMARK	25% RELEASE	25% 0%	25% 0%
ESTONIA	20%	0%	0%
FINLAND	REDUCED 10%	0%	0%
FRANCE	REDUCED 10%	REDUCED 10%	REDUCED 10%
GERMANY	19%	19% REDUCED 7%	19%REDUCED7%
GREECE	REDUCED 13%	REDUCED 13%	REDUCED 13%
HUNGARY	27%	0%	0%
IRELAND	RELEASE	0%	0%
ITALY	REDUCED 10% / RELEASE	0%	0%
LATVIA	21%REDUCED 12%	0%	0%
LITHUANIA	21% REDUCED 9%	0%	0%
LUXEMBOURG	3%	0%	0%
MALTA	18% 0%	-	-
NETHERLANDS	REDUCED 6%	REDUCED 6%	REDUCED 6%
POLAND	REDUCED 8%	REDUCED 8%	REDUCED 8%
PORTUGAL	REDUCED 6%	0%	0%
ROMANIA	24%	0%	0%
SLOVAKIA	20%	0%	0%
SLOVENIA	REDUCED 9,5%	REDUCED 9,5%	REDUCED 9,5%
SPAIN	REDUCED 10%	REDUCED 10%	REDUCED 10%
SWEDEN	REDUCED 6%	0%	0%
UK	20% 0%	0%	0%

Source: Study on the economic effects of current vat rules on passenger transport services

Despite the adopted directives related to VAT taxation, it is possible to notice in this paper that there are significant differences in the taxation of transport services. These differences are most visible at tax rates.

5. Conclusion

Transportation services in today's globalized world dominated by a consumer mentality are more significant than ever. Production is increasingly concentrated and produced in a smaller number of places, which is why transport services are becoming increasingly important. Due to the above mentioned, it is necessary to know the taxation of transport services. Precisely because of the free flow of goods and services,

the EU is trying to harmonize VAT taxation as the most chewable sales tax. In this paper, the general principles of VAT taxation are visible both within the Republic of Croatia and towards other EU members or towards third countries. The paper itself shows how important it is to know the rules of taxation within the VAT system because it does not matter to whom the invoices are issued to taxpayers or to someone who is not a taxpayer. The paper itself presented the specifics of taxation of the transport of goods and passengers in the provision of transport services between B2B and between B2C. What can create additional aggravating circumstances for transport services is the taxation according to the section of the road, which leads to the necessity of knowing the taxation in the various Member States of the European Union through which the transport passes.

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CONCENTRATION OF THE AUDIT MARKET IN THE REPUBLIC OF CROATIA

Tomislava Pavić Kramarić

University Department of Forensic Sciences, Split, Croatia
tpkramaric@unist.hr

Toni Šušak

University Department of Forensic Sciences, Split, Croatia
toni.susak@unist.hr

Nikolina Ančić

University Department of Forensic Sciences, Split, Croatia
nikolina.ancic@unist.hr

Paulina Bešker

University Department of Forensic Sciences, Split, Croatia
paulina.besker@unist.hr

Ella Vrvilo

University Department of Forensic Sciences, Split, Croatia
ella.vrvilo@unist.hr

Abstract. The most important commonality of audit markets worldwide is supremacy of the four global market leaders known as the Big Four – Deloitte, Ernst & Young, KPMG and PricewaterhouseCoopers. Situation regarding the audit services market in the Republic of Croatia does not deviate from the global trends and aforementioned companies have founded domestic limited liability companies that form a part of their enormous international audit networks and, thus, have considerable competitive advantage due to a resource disparity in comparison with other companies operating in this market. As in most other activities, increased competition should be desirable from the aspect of maintaining and enhancing auditor's independence and avoidance of potential conflicts of interests. Therefore, the aim of this paper implied providing an overview of different market concentration measures and variables used for their calculation, as well as analysing the values of various measures indicating the level of market concentration to determine how competitive the Croatian audit market in the period from 2016 to 2020 was. Besides analysing the dynamics of concentration in the audit market in Croatia, the authors determine whether there is a leader in the market and its potential impact on market structure. The data required for calculation of market concentration ratios was gathered from financial statements of all audit companies in the Republic of Croatia which have been submitted in an observed business year. The findings reveal that Croatian audit market is characterised with low levels of concentration as found with majority of concentration ratios used and no dominant firm is present.

Key words: *audit market, market concentration, Republic of Croatia*

1. Introduction

Despite the negative connotation of market concentration for wider public interests, firms have a different point of view and usually strive to increase their market shares because of underlying benefits (Ginevičius and Čirba, 2007). Tendencies of the audit firms do not differ significantly in comparison with companies from other activities, but

the audit markets are scrutinized more than most of the other markets (Oxera, 2007, in Velte and Stiglbauer, 2012) because of potential “monopolistic pricing, a decline in the quality of audits and of the services provided by audit firms, a decrease in the stability of capital markets and in investor confidence, and the impact of another large public accounting firm failure” (Cammack & Caban-Garcia, 2005, p. 3, in Velte and Stiglbauer, 2012, p. 147). These are the reasons why “the audit market is under constant monitoring of regulators and professional bodies” (Sever Mališ and Brozović, 2015, p. 339).

Generally, lower concentration on an audit market is considered desirable because “audit as a service is meaningful only if the stakeholders have confidence in the auditor’s opinion” and “the potential collapse of one of the major audit firms could disrupt the availability of audited financial information on large companies, damage investor trust and impact the stability of the financial system”, so “regulators are considering reforms to dilute the Big Four’s dominance and improve competition in the audit market” (Sever Mališ and Brozović, 2015, p. 342 and 343). “Prior studies have shown that high audit market concentration limits the choice of auditor for large companies and sets a high barrier of entry for mid-tier audit firms, while the effect on audit quality and audit fees is still unclear” (Sever Mališ and Brozović, p. 339).

On the other side, Francis, Michas and Seavey (2013) have founded that higher market shares of Big Four firms are not necessarily a downside, as regulators usually perceive it, given their potentially beneficial impact on financial reporting quality of clients audited by these firms. More specifically, they have focused on the concentration among the Big Four firms, in which disparities could have detrimental effects on financial reporting quality.

Regulators undertake various activities in an effort to decrease excessive concentration, such as:

- “mandatory audit firm rotation
- mandatory joint audit
- regular mandatory tendering of audit contracts
- change in ownership arrangements for auditors
- reform of the law of unlimited liability
- elimination of covenants which are restricting the choice of auditors
- establishment of the contingency plans for the potential demise of a Big Four audit firm” (Sever Mališ and Brozović, 2015, p. 343).

It is important to mention that measures taken in the audit market could have additional detrimental effects, as Bleibtreu and Stefani (2012, p. 41) showed that “prohibiting non-audit services as a measure intended to improve auditor independence can have counter-productive secondary effects on audit market concentration”.

The level of concentration on an audit market is usually measured using variables as “number of clients, audit fees and (since audit fees are not publicly disclosed in many countries) surrogates for audit fees such as client revenues or total assets” (Beattie, Goodacre and Fearnley, 2003, p. 253).

The main aim of this paper was to provide an overview of different market concentration measures (concentration ratios, Herfindahl-Hirschman index, Gini coefficient and entropy index) and variables used for their calculation, as well as to determine the competitiveness of the Croatian audit market in the period from 2016 to

2020. The paper is structured as follows – firstly, most significant concentration measures are presented. Afterwards, these measures are presented for the audit market in Republic of Croatia and, lastly, conclusions are made based on these results.

2. Concentration Measures

The choice of concentration ratios to be used with the aim of measuring the degree of concentration in the particular market depends primarily on the objectives of the research as well as on the characteristics of the market being explored. In order to avoid potential bias in the case of using one indicator, the use of multiple indicators seemed appropriate. Importance is given to both absolute and relative measures since the analysis is oriented towards differences arising from the market share.

Thus, based on the relevant literature dealing with the audit market concentration in this paper concentration ratios, Herfindahl-Hirschman index and Gini coefficient were applied following e.g. Wolk, Michelson & Wootton (2001), McMeeking, Peasnell & Pope (2007), Abidin, Beattie & Goodacre (2008), Bigus & Zimmermann (2008) and Clacher, de Ricquebourg & May (2019). Furthermore, the authors compute entropy index based on Mynhardt, Plastun & Makarenko (2014) and Antoniuk et al. (2020). A more comprehensive review of the concentration measures used in recent literature focusing on audit market is provided in Velte & Stiglbauer (2012).

Concentration ratio (CR) is computed as the sum of the market shares of a number of largest firms operating in the observed market. Depending on the size of the market expressed with the number of firms operating in it, CR can be represented with the percentage of the market controlled by the four, eight, 12 or 20 biggest firms (Hall & Tideman, 1967). The following expression is being used for its calculation:

$$CR_n = \sum_{i=1}^n s_i$$

with s_i standing for the market share of the i -th firm of the analysed industry whereas n represents the number of firms.

CR is a simple indicator of the level of concentration and, thus, it is widely used. Its higher values indicate a lower degree of competitiveness due to the fact that a small number of big firms account for a significant share in total assets/operating revenues. Shepherd & Shepherd (2004) categorised four main types of market structures which represent the various levels of competition and monopoly power that are summarized in table below.

Table 1 Type of Market Structures according to Concentration Ratios

Market Characteristics	Market Structure
One firm holds 100% market share	Pure monopoly
Market share of one firm > 40%; no close rivals	Dominant firm
> 60% of the market controlled by four firms	Tight oligopoly
< 40% of the market controlled by four firms	Effective competition (Loose oligopoly, Monopolistic competition, Perfect competition)

Source: Shepherd & Shepherd (2004), p. 13; 71-75

However, one should be aware of its limitations. E.g. Hall & Tideman (1967) suggest that the use of CR might lead to a conclusion that markets with different size distributions could be considered as equally concentrated adding that, possibly, it is not a good measure of monopoly. Furthermore, as suggested by Pasalic & Pavic (2021), when interpreting CR values one should be aware whether the products are sold mostly in the local, national or global market as these enjoy different levels of monopoly powers.

Herfindahl-Hirschmann index (HHI) is also commonly used concentration indicator. The importance given to the HHI also arises from the fact that regulatory bodies dealing with protection of market competition frequently use this indicator. According to the Horizontal Merger Guidelines (2010) provided by the US Department of Justice, markets can be classified into three categories encompassing unconcentrated markets with HHI values below 1500, moderately concentrated markets with HHI ranging from 1500 to 2500, while highly concentrated markets are characterised with HHI values above 2500. Furthermore, European Commission, based on the Guidelines on the assessment of horizontal mergers under the Council Regulation on the control of concentrations between undertakings (2004), uses HHI to detect potential horizontal competition concerns in merger activities.

It is calculated by adding the squares of the individual market shares of all the companies operating in the particular market giving the greater weight to the larger firms' market shares or using the following expression (e.g. Brezina et al. [2016] and Lu, Qiao & Chang [2017]).

$$HHI = \sum_{i=1}^n (s_i)^2$$

where s_i denotes market share of an individual firm while n is the total number of firms contained. If the single firm conducts its activities in a particular market controlling the entire supply ($s_i=100$), then the value of HHI equals to 10 000 ($HHI=(100)^2=10\ 000$). Thus, the HHI can range from close to zero reflecting an atomistic market up to 10 000 in the case of a pure monopoly. It is a comprehensive index since it takes into account market shares of all firms that are active in the market, however, as noted by Shepherd & Shepherd (2004), that is also its drawback since it requires more detailed information unlike concentration ratio.

Entropy index (E), introduced by Horowitz and Horowitz (1968), can also be used as a measure of concentration. As it is calculated as:

$$E = - \sum s * \ln(s)$$

with s is representing the firm's proportional market value within the observed industry. The value of the entropy index ranges from zero to $\ln(n)$ and is the opposite of the degree of concentration, i.e. the higher the entropy value the higher the level of competitiveness (Nawrocki & Carter, 2010). In case of pure monopoly, it takes value zero whereas its maximum level of $\ln(n)$ is computed as the logarithmic value of all companies (n) operating in the market and is reached when all market participants

have equal market shares and the level of concentration is the lowest. Its main advantage is that it gives weight to firms with smaller market shares (Tipurić, Pejić Bach & Pavić, 2008).

Gini coefficient (G) measures the deviation between distribution of cumulative market shares and a hypothetical uniform distribution with equal market shares measuring the degree of concentration relative to the number of firms on the market (Bigus & Zimmermann, 2008).

Since Gini coefficient stems from the Lorenz curve, if all the firms operating in the market are of equal size, the Lorenz curve is presented with the straight diagonal line of equality. On the contrary, in case of inequality in size of the firms, the Lorenz curve will be positioned below the line of equality. Thus, the Gini coefficient measures the area between the Lorenz curve and a hypothetical line of absolute equality (Mališ & Brozović, 2015).

It ranges between zero, denoting completely uniform distribution, and one, implying perfect inequality.

The formula for calculation of Gini coefficient stands as follows:

$$G = 1 - \frac{1}{n} \sum_{i=1}^n s_i + s_{i-1}$$

where s_i is the cumulative share of all individual firms with income less or equal to that of the i -th individual (Deltas, 2003). If the values of Gini coefficient come close to 1, high level of concentration is present. Specifically, Bigus & Zimmermann (2008) and Velte & Stiglbauer (2012) suggest that values of Gini coefficient below 0.4 indicate low market concentration, its values ranging between 0.4 and 0.6 indicate moderate market concentration while highly concentrated markets are characterised with G values above 0.6.

Market shares necessary for calculation of above mentioned concentration measures in the audit market can be computed on various bases encompassing audit fees, number of clients, total assets, sales revenues, operating revenues etc. (Velte & Stiglbauer, 2012). However, due to the data availability, the authors have opted for the basis including total assets following Bigus & Zimmermann (2008) and Mijić, Jakšić & Vuković (2013).

The initial sample employed in the analysis consisted of 200 audit firms listed in the Auditor register (The Ministry of Finance, n.d.). However, since not all of these firms operated in the entire observed period, the sample ranged from 182 to 198 firms in 2016 and 2020, respectively.

3. Dynamics of Concentration Indicators in the Croatian Audit Market

The levels of concentration in the Croatian audit market were quite dynamic and varied over time whether it is expressed with CR4, HHI, entropy index or Gini coefficient. The same holds true for the number of audit firms that operated in the observed period that ranges, as presented with Figure 1, from 182 in 2016 to 198 in 2020

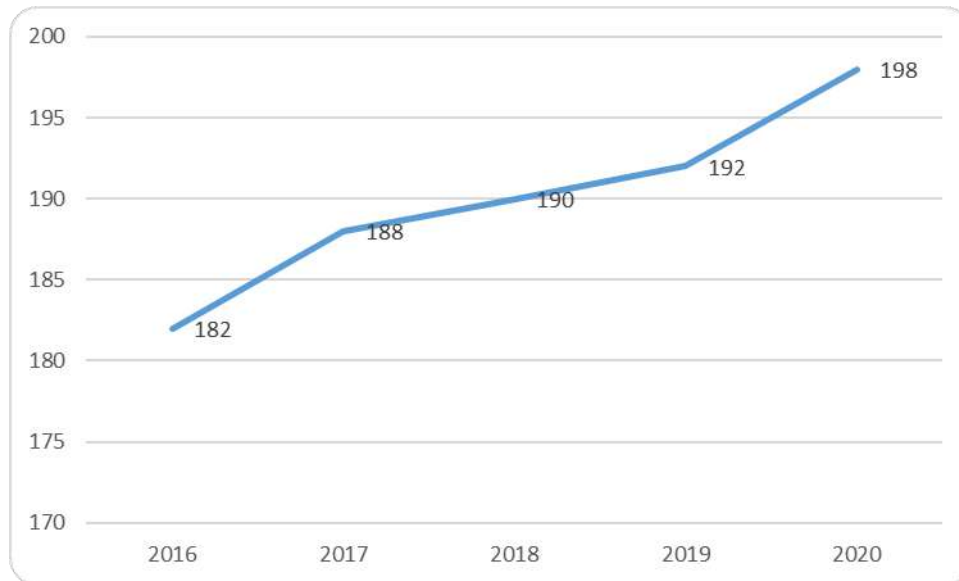


Figure 1 Number of audit firms in the Croatian market in 2016 - 2020
Source: authors' calculations

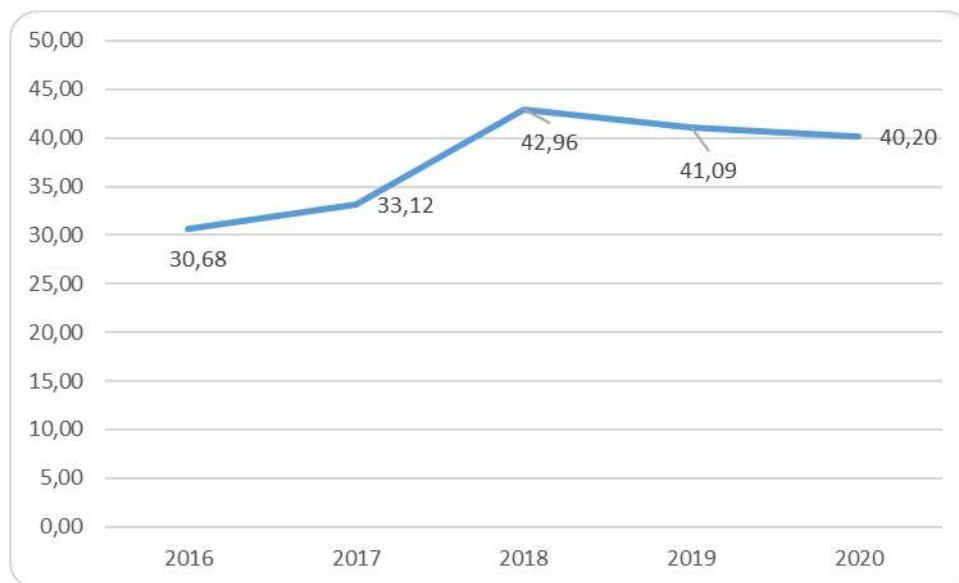


Figure 2 Dynamics of CR4 in in the Croatian audit market in 2016 - 2020
Source: authors' calculations

The market shares held by four largest audit firms, i.e. the values of CR4 enabled the authors to determine the market structure as well as the degree of market concentration. As it can be seen from the Figure 1, the values of CR4 varied over time with significantly low values achieved in 2016 and 2017 suggesting the market structure of effective competition. However, in the last three years of the period analysed CR4 registered higher values exceeding the threshold of 40%. It is worth noting, that these four leading audit firms are KPMG, Deloitte, Ernst&Young, and PWC suggesting the dominance of Big Four in the Croatian audit market as well.

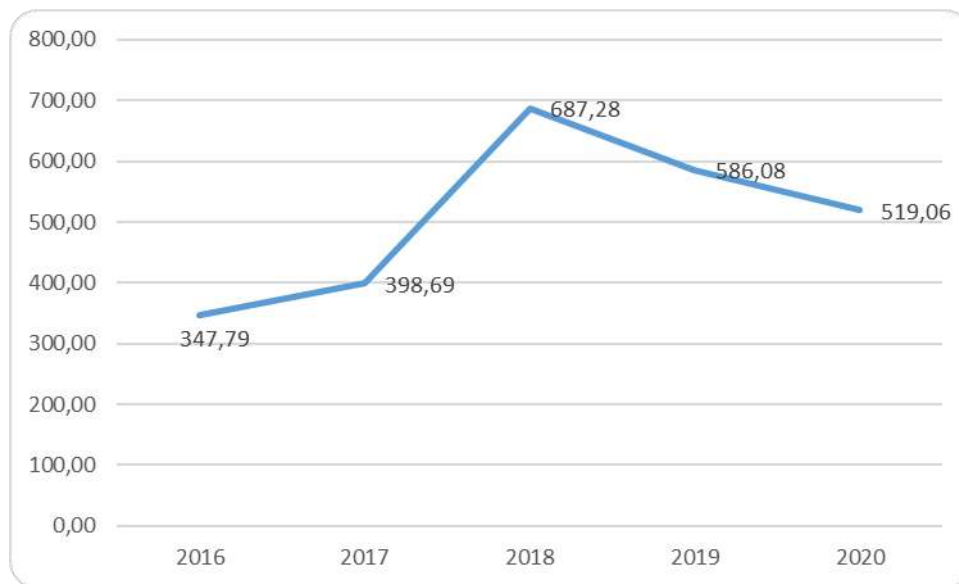


Figure 3 Dynamics of HHI in in the Croatian audit market in 2016 – 2020
Source: authors' calculations

Similarly to the findings regarding the level of concentration obtained with CR4, HHI values also vary significantly over time. Once again, the lowest levels were achieved in 2016 and 2017 while the highest value is reached in 2018, followed by a slight decline afterwards.

Nevertheless, in the entire observed period the values of HHI are significantly below 1500 suggesting low levels of concentration in Croatian audit market. It is noteworthy that the value of total assets of KPMG, the audit market leader, had more than doubled in 2018 comparing to the financial year 2017, mostly due to the fact that values of trade receivables and receivables from advance profit payments had risen. Also, the value of operating revenues had risen significantly (68,59%).

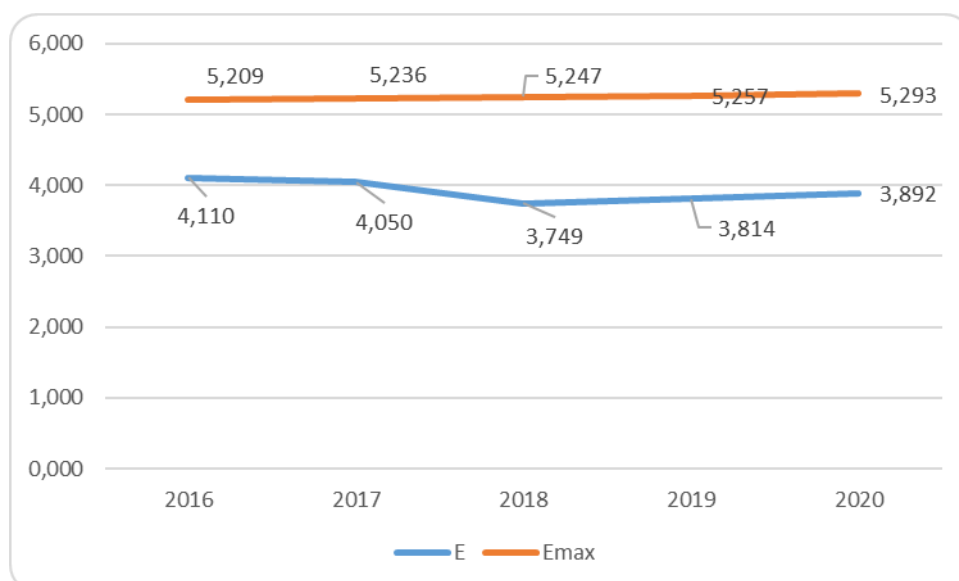


Figure 4 Dynamics of entropy index in the Croatian audit market in 2016 – 2020
Source: authors' calculations

The entropy index achieves the highest values in 2016 and 2017, approaching the maximum achievable values, whereas it decreases in 2018. In the last two years it moves towards the highest values suggesting an increase in competition.

The results regarding level of concentration in the audit market in Croatia are following the same pattern for the first three concentration measures used. This is also true for concentration ratio despite its drawbacks that it does not take into account relative size of the firms concerned nor the total number of firms operating in the market.

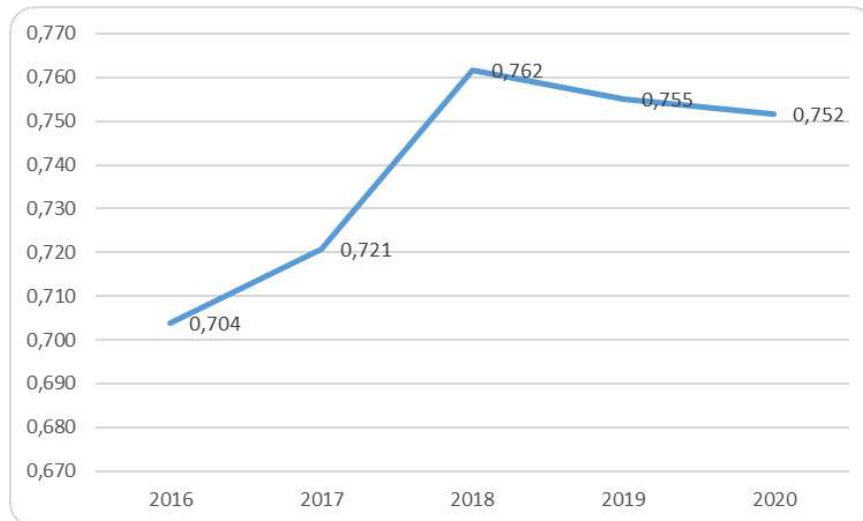


Figure 5 Dynamics of Gini coefficient in the Croatian audit market in 2016 – 2020
Source: authors' calculations

The values of Gini coefficient, as shown with Figure 5, also show an increase in the first three years whereas, after reaching the peak in 2018, a decline in concentration is evident. However, its values are constantly in the range between 0.6 and 0.9 suggesting high level of concentration.

The dynamics of concentration measures can be explained with the dynamics of market share held by the market leader KPMG presented with Figure 6. Specifically, the years 2016 and 2017 register its lowest values which slightly increase reaching the maximum in 2018 after which a decline occurs. Moreover, in the all observed period Croatian audit market is not characterised with the dominant firm.

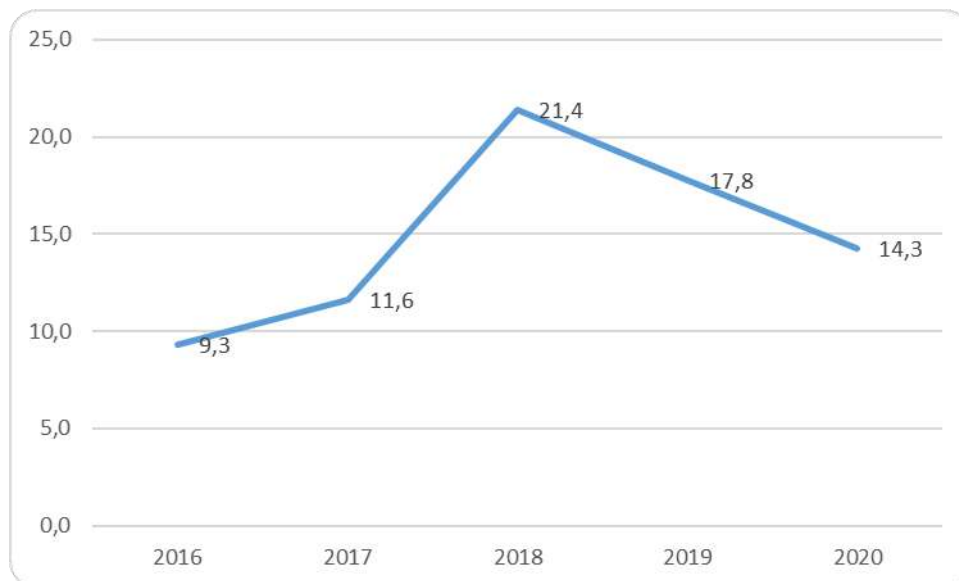


Figure 6 Market shares of market leader in the Croatian audit market in 2016 – 2020
Source: authors' calculations

Correspondingly to the findings on concentration levels in the audit markets in other countries, the BIG4 dominance has not avoided Croatia either. Despite the concerns expressed by the regulators arising from the dominance of BIG4 audit firms in terms of increased audit fees and reduced audit quality (Huang, Chang and Chious, 2016), the overall level of audit market concentration in Croatia, as obtained with the majority of concentration measures employed, is rather low indicating that it can be considered as highly competitive one.

4. Conclusion

Similar to all the audit markets in the world, the audit market in the Republic of Croatia is also characterised by the supremacy of the four global market leaders Deloitte, Ernst & Young, KPMG and PricewaterhouseCoopers, known as the Big Four, which have significant competitive advantages in comparison to other audit companies. Because of its important function in the context of economic stability, there are several issues that should be taken into the account when analysing competition in the audit market, such as avoiding the conflict of interests. Despite generally accepted view that high concentration of an audit market is detrimental and various measures undertaken with an aim of its reduction, there is no consensus among experts regarding this issue. According to the main aim of this paper and based on the concentration values calculated using different market concentration measures, it can be concluded that the level of audit market concentration in the period from 2016 to 2020 in the Republic of Croatia obtained with the majority of concentration measures is relatively low and indicates high level of competitiveness. Low levels of concentration are confirmed with CR4 which in the last year of the analysis accounts for 40,20 suggesting the effective competition. This is also confirmed with HHI which is well below 1500 threshold as well as with entropy index which reaches its maximum values that indicate higher competition. This could be perceived as positive regarding the independence of audit companies and, thus, it implies that no additional measures are needed in the Republic

of Croatia in this context. Furthermore, it can be added that Croatian audit market is not characterised with a dominant firm since in the entire observed period market shares of the leading audit firms are well below 40%.

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FINANCIAL PERFORMANCE OF AUDIT COMPANIES IN CROATIA

Ivica Filipović

University Department of Forensic Sciences, Split, Croatia
ivica.filipovic@unist.hr

Toni Šušak

University Department of Forensic Sciences, Split, Croatia
toni.susak@unist.hr

Viktoria Marković Rosan

University Department of Forensic Sciences, Split, Croatia
vmrosan@unist.hr

Ivana Stapić

University Department of Forensic Sciences, Split, Croatia
ivana.stapic@unist.hr

Vedrana Veić

University Department of Forensic Sciences, Split, Croatia
vedrana.veic@unist.hr

Abstract. The stability of the corporate sector substantially depends on the quality of assurance provided by independent auditors that annual financial statements of a company had been prepared in accordance with prescribed criteria, such as the International Accounting Standards and the International Financial Reporting Standards. One of the main specificities of external auditing is its mandatory nature – certain groups of companies, regarding their size and importance for the national economy, are required by accounting legislation to subject their annual financial statements to external control carried out by independent privately owned audit companies. Because demand for these services is largely predefined, the performance of audit companies is determined by their skills in fulfilling the needs of audit clients in comparison to other companies in the same activity. The purpose of this paper was to elaborate on the essential categories of indicators utilised for analysing financial performance and to conduct a financial analysis of audit companies using mentioned indicators over the five-year period from 2016 to 2020. The complete population of companies entrusted with performing external financial statement audits in the Republic of Croatia, which submitted their annual financial statements, was taken into consideration. Financial data was obtained from balance sheets and income statements available at the Register of Annual Financial Statements maintained by the Croatian Financial Agency.

Key words: *audit companies, Croatia, financial analysis*

1. Introduction

The audit profession is vital in the contemporary business environment and its services are highly demanded despite the accounting scandals that considerably eroded public confidence in audit activities (Filipović et al., 2018). In general, audit firms are perceived as a control mechanism in the context of compliance of their clients' annual financial statements with the accounting standards (Filipović et al., 2018). Besides

mentioned criteria, there is also legislation, as well as accounting politics and principles (Filipović, 2009). The quality of their services substantially determines the stability of the corporate sector because “entities of public interest and large and medium-sized enterprises that are not entities of public interest” are obliged by the Croatian Accounting Act to subject their “annual financial statements and annual consolidated financial statements” to the external control (Official Gazzette, 2015, art. 20).

Except for their vital role in the national economy mentioned above, audit firms are also required to publicly disclose their financial statements, in the same manner as companies from all other activities. They also compete between themselves in an audit market to improve their financial performance. It is extremely important to note that profitability “should not be earned at the expense of the integrity of the audit” and that “if there is a case for more work and higher fees, it should be made as such, but not by using the scope of the audit as a bargaining chip” (Lilling, n.d.). “Profitability and growth are long-term projects for any accounting firm, and a reputation for quality, with the strongest internal quality control policies and procedures, will attract the most desirable clients, the best professionals and the greater profit in the long term” (Lilling, n.d.). Research conducted by Chen et al. (2021, p. 2) has led to a conclusion that “Big-4 and non-Big-4 audit firms have fundamentally different profitability structures” – “Big-4 firms earn higher profit margins than non-Big-4 firms”. Also, there is a paper which showed rise of profitability in the period from 2016 to 2018 for audit firms in a neighbouring country comparable to the Republic of Croatia (Mijić i Rađo, 2021). According to this research, larger audit companies had a lower value of return on assets “because of their significant level of total assets” (Mijić i Rađo, 2021, p. 275).

This paper aims to present the essential categories of indicators (profitability, effectiveness, activity and leverage ratios) utilized for analyzing financial performance applicable to audit companies over the five-year period from 2016 to 2020. Given that at the start of 2020 the “global pandemic was declared” (World Health Organization, 2020, in Šušak, 2020) it will be interesting to analyse the financial performance of audit companies during that period because “the COVID-19 crisis has exacerbated the existing challenges facing businesses and exposed new risks that must be addressed” (Mickeler, 2020). The complete population of audit firms that had operated in Croatia and submitted their annual financial statements was included in the sample. Financial data was obtained from balance sheets and income statements available in the Register of Annual Financial Statements maintained by the Croatian Financial Agency.

2. Financial analysis of audit firms in Croatia in the period from 2016 to 2020

In this chapter, profitability, effectiveness, activity and leverage ratios are calculated in order to determine the financial performance of audit firms included in the Register of Auditors (Ministry of Finance, n.d.) from 2016 to 2020. Financial ratios are calculated in order to make an “evaluation of financial position and movements of a certain company and evaluation of its business capabilities” (Belak, 2014, p. 1). One should be aware that financial statements are susceptible to manipulative actions, such as “concealment of losses” or “concealment of debt by falsifying the balance sheet” (Belak, 2017, p. 4), so additional attention should be directed to this issue.

The following ratios were employed in the analysis:

Table 1 Financial ratios applied for financial analysis of audit firms

Financial ratio	Calculation
<i>Profitability ratios</i>	
Return on assets	Net profit/Total assets
Return on equity	Net profit/Equity and reserves
<i>Effectiveness ratios</i>	
Operating effectiveness	Total revenues/Total expenses
<i>Activity ratios</i>	
Assets turnover ratio	Total revenues/Total assets
<i>Leverage ratios</i>	
Leverage ratio	Total liabilities/Total assets

Source: adapted financial ratios from Žager et al. (2017)

In Table 2 financial ratios of audit firms in the financial year 2016 are compared. The average profitability of all firms is relatively high and, as expected, the Big Four firms (29%) are approximately twice as profitable in comparison to other audit firms (14%) when analyzing the return on assets ratio. Other audit firms have recorded higher operating effectiveness than the Big Four firms (1,28 in comparison to 1,20), as well as a slightly higher leverage ratio (55% compared to 52%), while the Big Four firms had a higher assets turnover ratio (2,44 compared to 1,36).

Table 2 Financial analysis of audit firms in 2016

Financial ratio	Big Four	Other audit firms	All audit firms
<i>Profitability ratios</i>			
Return on assets	0,29	0,14	0,14
Return on equity	0,69	0,48	0,48
<i>Effectiveness ratios</i>			
Operating effectiveness	1,20	1,28	1,28
<i>Activity ratios</i>			
Assets turnover ratio	2,44	1,36	1,36
<i>Leverage ratios</i>			
Leverage ratio	0,52	0,55	0,55

Source: Authors' analysis using financial statements publicly available in the Register of Annual Financial Statements maintained by the Croatian Financial Agency.

Similar trends were recorded concerning the values of audit firms' financial ratios in the subsequent financial year (2017), as shown in Table 3, except for the leverage ratio employed. The average profitability of the entire population is relatively high, with an expected difference in favor of the Big Four firms (30%) in comparison to other audit firms (20%). Other audit firms had higher operating effectiveness than the Big Four firms (1,29 in comparison to 1,23), while the Big Four firms had a higher assets

turnover ratio (2,13 compared to 1,38), as well as a higher leverage ratio (53% compared to 47%).

Table 3 Financial analysis of audit firms in 2017

Financial ratio	Big Four	Other audit firms	All audit firms
<i>Profitability ratios</i>			
Return on assets	0,30	0,20	0,20
Return on equity	0,74	0,44	0,45
<i>Effectiveness ratios</i>			
Operating effectiveness	1,23	1,29	1,29
<i>Activity ratios</i>			
Assets turnover ratio	2,13	1,38	1,40
<i>Leverage ratios</i>			
Leverage ratio	0,53	0,47	0,47

Source: Authors' analysis using financial statements publicly available in the Register of Annual Financial Statements maintained by the Croatian Financial Agency.

The values of audit firms' financial ratios in the financial year 2018 are similar to the financial year 2016, except for the value of the operating effectiveness ratio (Table 4). The difference in profitability measured by return on assets was more than three times higher in favor of the Big Four firms (40%), which were considerably more profitable in comparison to other audit firms (13%). Dissimilar to 2016 and 2017, other audit firms accomplished lower operating effectiveness than the Big Four firms (1,30 in comparison to 1,42), as well as lower assets turnover ratio (1,41 compared to 1,97), while the Big Four firms were less leveraged than other audit companies (44% compared to 58%), what indicates considerable turnaround in context of the preceding financial year.

Table 4 Financial analysis of audit firms in 2018

Financial ratio	Big Four	Other audit firms	All audit firms
<i>Profitability ratios</i>			
Return on assets	0,40	0,13	0,14
Return on equity	0,89	0,42	0,43
<i>Effectiveness ratios</i>			
Operating effectiveness	1,42	1,30	1,30
<i>Activity ratios</i>			
Assets turnover ratio	1,97	1,41	1,43
<i>Leverage ratios</i>			
Leverage ratio	0,44	0,58	0,57

Source: Authors' analysis using financial statements publicly available in the Register of Annual Financial Statements maintained by the Croatian Financial Agency.

The situation regarding the values of selected financial ratios did not differ substantially in the financial year 2019 (Table 5) compared to the preceding year. The average profitability of all firms is relatively high and the Big Four firms (40%) are considerably more profitable in comparison to other audit firms (18%). Other audit firms have recorded lower operating effectiveness than the Big Four firms (1,30 in comparison to 1,42), as well as lower assets turnover ratio (1,36 compared to 1,92), while the Big Four firms were less leveraged than other audit companies (45% compared to 55%).

Table 5 Financial analysis of audit firms in 2019

Financial ratio	Big Four	Other audit firms	All audit firms
<i>Profitability ratios</i>			
Return on assets	0,40	0,18	0,19
Return on equity	0,82	0,31	0,33
<i>Effectiveness ratios</i>			
Operating effectiveness	1,42	1,30	1,31
<i>Activity ratios</i>			
Assets turnover ratio	1,92	1,36	1,37
<i>Leverage ratios</i>			
Leverage ratio	0,45	0,55	0,55

Source: Authors' analysis using financial statements publicly available in the Register of Annual Financial Statements maintained by the Croatian Financial Agency.

Table 6 contains the comparison of audit firms' financial ratios in 2020. The average profitability of all firms is relatively high and the Big Four firms (41%) are slightly less than twice as profitable in comparison to other audit firms (21%). The Big Four firms have recorded slightly higher operating effectiveness than other audit firms (1,34 in comparison to 1,30), as well as a higher assets turnover ratio (2,10 compared to 1,32), while other audit companies had significantly considerably higher leverage in comparison to the Big Four firms – 21 percentage points (63% compared to 42%).

Table 6 Financial analysis of audit firms in 2020

Financial ratio	Big Four	Other audit firms	All audit firms
<i>Profitability ratios</i>			
Return on assets	0,41	0,21	0,21
Return on equity	0,86	0,39	0,40
<i>Effectiveness ratios</i>			
Operating effectiveness	1,34	1,30	1,30

<i>Activity ratios</i>			
Assets turnover ratio	2,10	1,32	1,34
<i>Leverage ratios</i>			
Leverage ratio	0,42	0,63	0,62

Source: Authors' analysis using financial statements publicly available in the Register of Annual Financial Statements maintained by the Croatian Financial Agency.

Generally, the Big Four audit firms were more profitable in all financial years as expected. The other audit firms had recorded slightly higher operating efficiency in 2016 and 2017, but subsequently, trends turned in favor of the Big Four firms. The asset turnover ratio was considerably higher for the Big Four firms in all analyzed financial years and the other audit firms had a higher leverage ratio in all years with exception of 2017.



Figure 1 Return on assets ratio movements for the audit firms that operated in Croatia from 2016 to 2020

Source: Authors' creation using financial statements publicly available in the Register of Annual Financial Statements maintained by the Croatian Financial Agency.

Figure 1 indicates movements of return on assets for audit companies that have operated in Croatia from 2016 to 2020. This ratio increased constantly over the analyzed period for the Big Four firms. The same could be said for the other audit firms, with the exception of the financial year 2018 when the average value of return on assets decreased by approximately 7 percentage points.

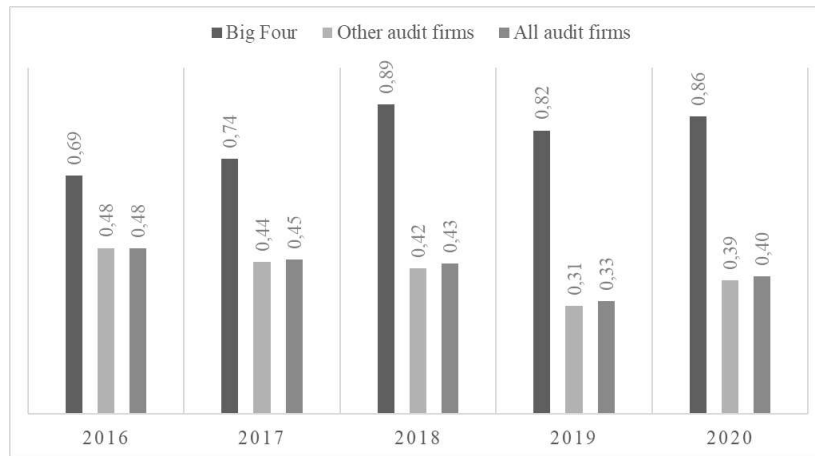


Figure 2 Return on equity ratio movements for the audit firms that operated in Croatia from 2016 to 2020

Source: Authors' creation using financial statements publicly available in the Register of Annual Financial Statements maintained by the Croatian Financial Agency.

Figure 2 indicates movements of return on equity for audit companies that have operated in Croatia from 2016 to 2020. This ratio increased constantly over the analyzed period for the Big Four firms, with the exception of the financial year 2019 when the average value decreased by approximately 7 percentage points. On the other side, other audit firms experienced a constant decrease in return on equity, with the exception of the financial year 2020 when the average value of return on equity increased by approximately 8 percentage points.

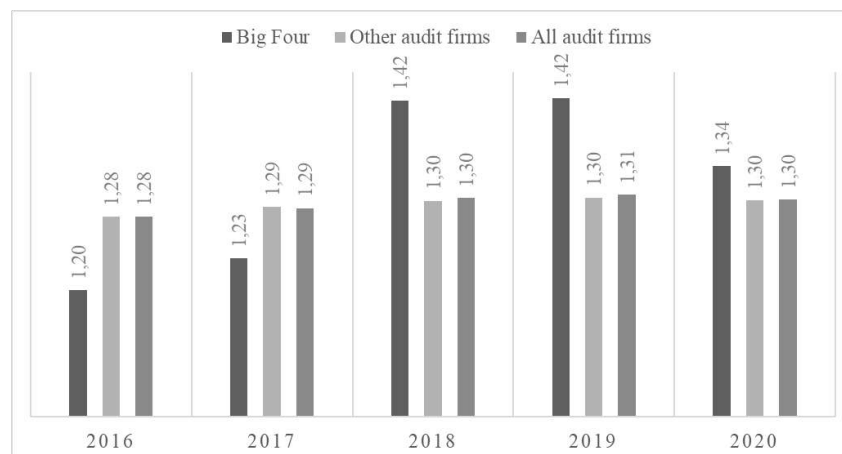


Figure 3 Operating effectiveness ratio movements for the audit firms that operated in Croatia from 2016 to 2020

Source: Authors' creation using financial statements publicly available in the Register of Annual Financial Statements maintained by the Croatian Financial Agency.

Figure 3 indicates movements of operating effectiveness for audit companies that have operated in Croatia from 2016 to 2020. This ratio increased constantly over the analyzed period for the Big Four firms, with the exception of the financial year 2020 when the average value decreased by approximately 0,08. Movements had been the

same in the case of the other audit firms until 2018 when stagnation of this ratio commenced.



Figure 4 Assets turnover ratio movements for the audit firms that operated in Croatia from 2016 to 2020

Source: Authors' creation using financial statements publicly available in the Register of Annual Financial Statements maintained by the Croatian Financial Agency.

Figure 4 indicates the movements of assets turnover ratio for audit companies that have operated in Croatia from 2016 to 2020. This ratio constantly decreased over the analyzed period for the Big Four firms, with the exception of the financial year 2020 when the average value increased by approximately 0,18. On the other side, other audit firms experienced an increase until 2018 when the value of this ratio peaked and decreased in the period after that.



Figure 5 Leverage ratio movements for the audit firms that operated in Croatia from 2016 to 2020

Source: Authors' creation using financial statements publicly available in the Register of Annual Financial Statements maintained by the Croatian Financial Agency.

Figure 5 indicates the movements of leverage ratio for audit companies that have operated in Croatia from 2016 to 2020. This ratio increased until 2017, and in the following period the Big Four firms have mostly deleveraged. On the other side, other audit firms had the lowest value in 2017, after which the value of this ratio increased significantly to the highest value in 2020.

3. Conclusion

Despite the important role of audit firms for an entire economy, they also compete within the audit market to attract clients, thus their financial performance is also an important attribute to consider. Given their competitive advantage in resources, the Big Four firms have proven to be more profitable than other audit firms. These companies are also the most reputable in the international audit market, which puts them in a more favorable position compared to all other companies. The financial analysis conducted in this paper has proven that these companies utilize less leverage than other companies. Given that the financial year 2020 is also included in the sample, it is interesting to observe were the values of these ratios affected by the global pandemic and the COVID-19 crisis and to what extent. It could not be stated that the COVID-19 crisis considerably affected the profitability of the audit firms because the majority of the ratios improved in comparison to the preceding financial year. Regarding the leverage ratio, the Big Four firms slightly deleveraged during the pandemic, while the level of other audit firms' indebtedness became noticeably higher which could indicate that the first year of the pandemic was more challenging for the audit firms which are not part of the Big Four. Future research should determine reasons of the better performance of the Big Four companies and the reason why higher leverage level of non-Big For companies did not manifest in increased profitability.

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THE APPLICATION OF DISCRETIONARY ACCRUALS AS A MEASURE OF EARNINGS MANAGEMENT IN THE REPUBLIC OF CROATIA

Ivica Filipović

University Department of Forensic Sciences, Split, Croatia
ivica.filipovic@unist.hr

Marijana Bartulović

University Department of Forensic Sciences, Split, Croatia
marijana.bartulovic@unist.hr

Tomislava Pavić Kramarić

University Department of Forensic Sciences, Split, Croatia
tomislava.pavic.kramaric@unist.hr

Toni Šušak

University Department of Forensic Sciences, Split, Croatia
toni.susak@unist.hr

Abstract. The accounting scandals that had occurred at the beginning of the 21st century have emphasized the importance of access to unbiased financial information. Those initial occurrences were only a prelude to the global wave of creative accounting cases involving large multinational companies which had not passed the Republic of Croatia either. There is a wide variety of motivational factors which provide companies with an impetus to manage earnings, as well as different types of earnings management measures, whose main features are presented in the theoretical part of this paper. The earnings management construct was measured using aggregate discretionary accrual measures. The main objective of the paper was to give an insight into the level of manipulation in accounting records of corporations listed at the capital market in the Republic of Croatia and to compare values of different accrual measures estimated for the period from 2017 to 2019. Also, the signs of discretionary accrual values were examined to determine if companies have the tendency of overestimating or underestimating their financial performance. The sample of companies was collected from publicly available financial information on the financial position, financial performance and cash flows disclosed by companies listed on the official website of the Zagreb Stock Exchange.

Key words: *aggregate discretionary accruals, Croatia, earnings management, listed companies, specific accruals*

1. Introduction

Firm's financial reports are expected to present trustworthy and factual situation about the firms' activities and financial position. Specifically, according to the Croatian Accounting Act (National Gazette 78/15, 134/15, 120/16, 116/18, 42/20, 47/20), "annual financial statements shall provide a true and fair view of the financial position and business performance of the respective entrepreneur".

Firms' earnings quality, considered as one of the key information required by investors in decision-making processes regarding common stock investments (Chansarn & Chansarn, 2016), reflects the credibility of earnings, i.e. the accurate firm performance.

However, it can be adversely impacted by earnings management or firm efforts to manipulate reported earnings. Moreover, it is also viewed as an adjustment of financial reports and structuring of firm activities with the aim of misleading investors about the firm economic performance (Li & Chen, 2020). This can be done, as suggested by Akers, Giacomino & Gissel (2007), through application of particular accounting methods and recognizing one-time non-recurring items, or, as documented by Oskouei & Sureshjani (2021), through deferrals of the expenses detection and acceleration of revenues recognition as well as via other means. Specifically, accounting uncertainties including provisions and accruals enable managers to present beneficial financial performance of the firms by using the most favourable method (Aladwan, 2019). As noted by Saona & Muro (2018), the discretionary accruals are usual means to purposely “manipulate earnings in favour of managers’ interests” while Atieh & Hussain (2012) state that “working capital discretionary accruals are a superior indicator of earnings management than more commonly used measures of total discretionary accruals”.

Although earnings management is regularly viewed as an undesirable behaviour of firms which can affect both their reputation and credibility as well as their stock performance (Chansarn & Chansarn, 2016), it is also, as suggested by Kliestik et al. (2021) citing Healy (1985), “reasonable and legal management decision-making and reporting intended to achieve stable and predictable financial results”.

In recent decades the importance of earnings management has grown significantly (Türegün, 2020) gaining attention of managers, regulators and the general public. According to Kliestik et al. (2021), it is also “one of the most challenging, debated and controversial topics in finance and financial management.” Thus, the objective of this paper is to provide more insight to the issue of earnings management and earnings management practices by examining the role of earnings management in an emerging market such as Croatian. Specifically, the authors will provide evidence whether earnings management practices are common in the national setting of Croatian non-financial firms listed on Zagreb Stock Exchange (ZSE) in the 2017 – 2019 period.

2. Earnings management measures

In large number of models developed for measuring earnings management practices accruals or more precisely “discretionary accruals act as a proxy to earnings manipulation” (Goel, 2012). For example, Healy (1985) used total accruals as a measure of earnings management. Similar approach was adopted by DeAngelo (1986) and this model can be considered as a version of Healy model due to the fact that both models use “total accruals from the estimation period as proxy for expected nondiscretionary accruals” (Dechow et al, 1995). Total accruals are comprised of discretionary and nondiscretionary component. Discretionary accruals represent accrual component which cannot be observed directly from financial statements and therefore they should be estimated by adequate model.

To calculate discretionary component of total accruals models like Healy model (1985), DeAngelo model (1986), the Jones model (1991) or Modified Jones model were used. On-the other side, nondiscretionary accruals are “accounting-based adjustments in the cash flow of the financial statement” (Rao & Dandale, 2008, cited in Ilmas et al, 2018)

and they can be observed through financial statements. Thus, models developed for measuring earnings management are focused on measuring discretionary accruals.

The starting point in this process is determining total accruals which are usually calculated as difference between net income and net operating cash flows in year t . When total accruals are determined they are separated into a discretionary and a nondiscretionary component.

The Jones model (1991) and the modified Jones model (1995) are widely used in earnings management literature to divide total accruals into discretionary and nondiscretionary component and are also used for detecting earnings management practices on Croatian capital market. One of the main assumptions of the Jones model (1991) is the premise how nondiscretionary accruals are constant. Jones model is described as (Ilmas et al., 2018):

$$TA_{it} / A_{it-1} = \alpha_1 [1 / A_{it-1}] + \alpha_2 [\Delta REV_{it} / A_{it-1}] + \alpha_3 [PPE_{it} / A_{it-1}] + e_{it} \quad (1)$$

where:

TA_{it} = total accruals for company i at the end of financial year t ,

A_{it-1} = total assets for company i at the end of previous financial year $t-1$,

ΔREV_{it} = difference in revenues between financial year t and financial year $t-1$ for company i ,

PPE_{it} = property, plant and equipment for company i at the end of financial year t ,

α_1 , α_2 and α_3 = regression coefficients

e_{it} = residual (measure of discretionary accruals).

Total accruals in the model are calculated as difference between net income and net operating cash flows for company i , in year t .

The Modified Jones model

One of the assumptions of the original Jones model is that revenues are nondiscretionary. In order to resolve issue of measuring discretionary accruals with error when management uses discretion over revenues, modified Jones model was formed. With Modified Jones model discretionary accruals are measured as follows (Ilmas et al., 2018):

$$TA_{it} / A_{it-1} = \alpha_1 [1 / A_{it-1}] + \alpha_2 [\Delta REV_{it} - \Delta REC_{it} / A_{it-1}] + \alpha_3 [PPE_{it} / A_{it-1}] + e_{it} \quad (2)$$

where:

TA_{it} = total accruals for company i at the end of financial year t ,

A_{it-1} = total assets for company i at the end of previous financial year $t-1$,

ΔREV_{it} = difference in revenues between financial year t and financial year $t-1$ for company i ,

ΔREC_{it} = difference in account receivables between financial year t and financial year $t-1$ for company i ,

PPE_{it} = property, plant and equipment for company i at the end of financial year t ,

α_1 , α_2 and α_3 = regression coefficients
 μ_{it} = residual (measure of discretionary accruals).

In Modified Jones model total accruals are calculated same as in the original Jones model - as difference between net income and net operating cash flows in year t and residual value from the regression model represents the measure of discretionary accruals.

The Jones model and the Modified Jones model were used to measure discretionary accruals and determine the level of manipulation in financial statements of corporations listed at the capital market in the Republic of Croatia. Results of the Jones model and the Modified Jones model were compared in order to determine which model is better on developing market such as Croatian capital market.

Also, research was expanded by analysing the signs of discretionary accrual values to determine if companies have the tendency of overestimating or underestimating their financial performance. Research results are presented in the following section.

3. Results of earnings management values estimation

In this section the earnings management construct was measured using aggregate discretionary accrual measures – values of Jones model from 1991 and Modified Jones model from 1995 were estimated for companies which were listed at the stock market in the Republic of Croatia during the three-year period from financial year 2017 to financial year 2019. The values of accounting items were gathered from financial statements publicly available at the Zagreb Stock Exchange official website. Financial data was analysed using statistical software Past (Hammer, Harper and Ryan, 2001).

For the estimation of regression models required for calculation of earnings management values only industries “with at least ten observations” were taken into account following the approach of Ayers, Jiang and Yeung (2006, p. 622), while other industries were eliminated from the further analysis. Also, “the overall propensity to earnings management is measured by estimating discretionary accruals in absolute value as accruals can be used opportunistically either to inflate or reduce earnings” (Kourdoumpalou and Drogalas, 2022, p. 68). When utilizing the approach with absolute values, its “higher value shows low earnings quality” (Rashid Khan, 2022, p. 376).

Table 1 Jones model and Modified Jones model - absolute values

	Jones model	Modified Jones model
2017	0,046	0,047
2018	0,060	0,057
2019	0,047	0,048
Total	0,051	0,051

Source: authors' calculations using financial statements publicly available at the Zagreb Stock Exchange official website.

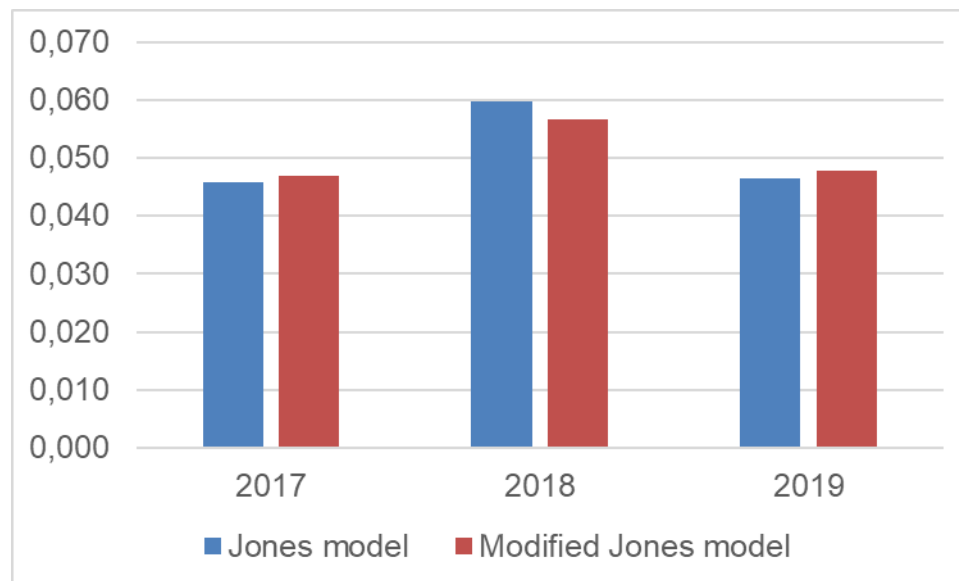


Figure 1 Jones model and Modified Jones model - absolute values

Source: authors' creation using financial statements publicly available at the Zagreb Stock Exchange official website.

Given that the only difference between the Jones model (Equation 1) and the Modified Jones model (Equation 2) is “the difference in account receivables between financial year t and financial year $t-1$ for company i ” (ΔREC_{it}) as noted in Equation 2, it was expected that the values of these two model will not differ significantly. Results have proven that the presumption was valid. Correlation analysis indicated that there is extremely strong correlation between the values of those two models ($r = 0,97$; $p = 0.00001$). The results of the correlation analysis mentioned above are also visible when analysing the results in Table 1 and Figure 1 because the values do not differ significantly. Earnings management values were at the highest point in financial year 2018, and at the lowest point in financial year 2017.

Table 2 Jones model and Modified Jones model – standard deviations

	Jones model	Modified Jones model
2017	0,066	0,066
2018	0,091	0,089
2019	0,055	0,056
Total	0,072	0,071

Source: authors' calculations using financial statements publicly available at the Zagreb Stock Exchange official website.

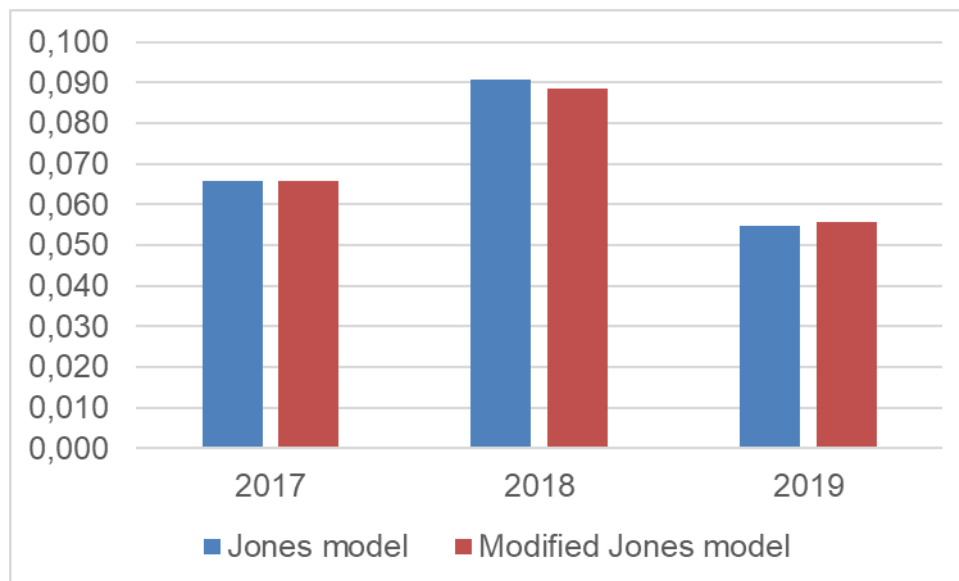


Figure 2 Jones model and Modified Jones model – standard deviations

Source: authors' creation using financial statements publicly available at the Zagreb Stock Exchange official website.

As it is evident from the Table 2 and Figure 2, highest variability of the absolute values of discretionary accruals for the Jones model and the Modified Jones model was calculated for financial year 2018 (SD = 0,091 and 0,089), while the lowest variability was calculated for the financial year 2019.

Table 2 Jones model - number of companies with positive and negative discretionary accruals

	Positive discretionary accruals	Negative discretionary accruals
2017	24	37
2018	31	30
2019	30	31
Total	85	98

Source: authors' calculations using financial statements publicly available at the Zagreb Stock Exchange official website.

Table 3 Modified Jones model - number of companies with positive and negative discretionary accruals

	Positive discretionary accruals	Negative discretionary accruals
2017	25	36
2018	34	27
2019	29	32
Total	88	95

Source: authors' calculations using financial statements publicly available at the Zagreb Stock Exchange official website.

Table 4 Jones model - values of positive and negative discretionary accruals

	Positive discretionary accruals	Negative discretionary accruals
2017	0,058	-0,038

2018	0,055	-0,065
2019	0,048	-0,046
Total	0,053	-0,049

Source: authors' calculations using financial statements publicly available at the Zagreb Stock Exchange official website.

Table 5 Modified Jones model - values of positive and negative discretionary accruals

	Positive discretionary accruals	Negative discretionary accruals
2017	0,057	-0,04
2018	0,051	-0,064
2019	0,051	-0,046
Total	0,053	-0,049

Source: authors' calculations using financial statements publicly available at the Zagreb Stock Exchange official website.

Also, the distinction between positive and negative discretionary accruals was made. As it is shown in Tables 3 and 4, there were more companies with negative accruals in financial year 2017 and 2019, while there were more companies with positive discretionary accruals in financial year 2018. Results in Table 5 and 6 show that positive discretionary accruals were highest in financial year 2017, and at the lowest point in financial year 2019. Intensity of negative discretionary accruals was highest in financial year 2018, and lowest in financial year 2017.

4. Conclusion

The main objective of the paper was to give an insight into the level of manipulation in accounting records of corporations listed at the capital market in the Republic of Croatia and to compare values of accrual measures estimated for the period from financial year 2017 to financial year 2019. As expected, the values of Jones model and the Modified Jones model did not differ significantly over the analysed three-year period, what was expected due to the slight differences between these two models. Highest intensity of absolute discretionary accruals was registered in financial year 2018, while the lowest values were registered in financial year 2017, despite the fact that the differences in comparison to financial year 2019 were slight. Similar to the values of earnings management intensity, variability of discretionary accruals was at the highest point in financial year 2018. Besides the values of absolute discretionary accruals, the signs of discretionary accrual values were also examined to determine if companies have the tendency of overestimating or underestimating their financial performance. The highest difference between companies with negative accruals and companies with positive discretionary accruals was recorded in financial year 2017 in favour of negative discretionary accruals, which means that majority of companies underestimated their financial results. Finally, the timespan included in analysis should be prolonged in future research to investigate correlations between different approaches.

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INSURANCE MARKET IN PANDEMIC CIRCUMSTANCES

Domagoja Buljan Barbača, PhD

Department of Professional Studies, University of Split, Split, Croatia
dobuljan@oss.unist.hr

Jelena Laća Mrdeža, PMFAcc

Elementary School Sućidar, Split, Croatia
jelenalaca@yahoo.com

Željka Ruščić, BC mathematics and physics

Elementary School Skalice, Split, Croatia
zeljka.ruscicm@gmail.com

Abstract. Insurance market products help individuals and companies to face everyday risks without worries regarding financial compensation in case that damage occurs. Insurance products are usually divided by criteria of the nature of the object/subject of insurance and the voluntary nature of consumption: 1. life and non-life insurance and 2. mandatory and voluntary insurance. The subject of insurance trade, simplified, is the sense of security that a person who buys an insurance policy acquires by handing over risk to the insurance company. Development of insurance in terms of diversity of offer and performances of products was always following real needs of persons exposed to risks. True time risks are changing and also the perception and the value of insurance coverage. If we were to analyse this changes true 17th century until today, we would find out that each time people have been faced with new challenges like natural disasters or other threats to life and property, the insurance market in terms of offer would evolve. Since 2020 humanity is faced with one of the biggest challenges - corona virus pandemic. This circumstances have changed intensity and occurrence of many risks and created some new ones that are affecting not only health and life of people, but indirectly are affecting all aspects of human beans lives. In the focus of this paper is Croatian insurance market. Changes on the market will be analysed and presented within conclusion.

Key words: *insurance market, corona virus pandemic, new risks*

1. Introduction

The Covid-19 virus pandemic has raised many new challenges in various industries from which some new solutions have emerged, the applicability of which is possible not only in extraordinary circumstances, but also in standard business conditions. The insurance industry and the basic work process that takes place in it, and that is sales, in its nature requires close contact with customers. Sharing important information on clients' needs, modelling an adequate offer, while respecting all legislative and regulatory provisions have fastened implementation of new technological solutions. Digitalization and its introduction into the real business everyday life application in insurance companies had to be implemented rapidly.

Required adjustments that were not only necessary to be implemented at the insurance

company level, but also included in the scope of the legislative framework, have also questioned the importance and level of IT literacy in addition to financial literacy, of all insurance product users.

Insurance business has only one process which generates profit-sales process. The insurance activity is specific because in relation to other activities it starts with the sale, not the production of its products, insurance services. (Stipić, Jurilj, 2015, 95) Digitalization of business processes in insurance companies in the Republic of Croatia began about ten years ago because it was recognized how much new technologies can contribute to the efficiency of work processes. By focusing on problems that technologies such as cloud, Internet of Things, blockchain, telematics, artificial intelligence, smart contracts and similar technological solutions, can solve, it is clear that they can create conditions to speed up the process of resolving claims, reduce administrative costs, prevent various types of fraud and similar challenges that insurance companies are faced with. (Anđelinović M. and Validžić A., 2019, 32) This beneficial effect of new technological solutions is indisputable, but it is questionable whether and to what extent these solutions can be implemented in all working processes of insurance companies. Because of such important role that sales play for the existence of insurance companies' deeper analyses should be made on predicted efficiency in new circumstances.

The sales process is a fundamental work process that is also the only work process that brings income to insurance companies. Without a successful sale and collection of payment for the service, the insurer cannot perform its task - economic protection of persons and their property in the event of an insured event. (Barbir, 2004, 815) Insurance distribution business faced great challenges at the time of the pandemic. The basic rule is that the service must be available to the potential and / or actual insured at the right time, in the right place, quantity and with the properties required by the insured (Stipić, Jurilj, 2015, 96) and pandemic circumstances made almost impossible for insurance companies to follow it. Following in the footsteps of technological progress, almost all insurance companies use a multi-channel sales strategy. In the basic division, we distinguish classic and alternative distribution channels that can be part of the internal or external network of insurers. The results of a survey conducted on the Croatian insurance market in 2020 (Mihelja Žaja, M., Milanović Glavan, Lj. And Grgić, M., 2020) indicate that policyholders prefer personal contact.

In the conditions of the pandemic that limited the personal contact of the insured and the insurer, a way had to be found to replace this personal contact, which is so important in the sales process, with an alternative, digital, and efficient version. Internet sales were, according to their basic classification, alternative sales channels, and in the conditions of a pandemic, they became unavoidable. The use of the Internet as a communication tool in insurance distribution, regardless of the distribution channel in question, becomes a necessity in these circumstances. Various insurance companies are introducing virtual platforms into their day-to-day operations. Meetings, trainings and sales are transferred to ZOOM, MS Teams, Skype and similar virtual platforms and social networks.

Adaptation of new approaches and technologies are to be observed and the business results obtained by insurance industry and insurance companies will be displayed and analysed.

2. Changes in insurance products and insurance business in pandemic times

The COVID 19 crisis continues to have a significant impact on individuals, society, business

and the wider economy across the globe. The insurance industry has not escaped its impact but insurers have responded quickly to the crisis. As the broader economy recovers and responds to the pandemic, insurers will face a number of challenges but also see many new opportunities. The impact on general insurers vary depending on the products and types of coverage offered by the insurers. The pandemic has taken a toll on new premiums on certain lines of business, such as travel, events, and trade credit insurance, and losses from these lines of business may become significant. There were challenges with contact centre operations and with provider services. Those insurers that had developed digital capability have been in a better position to respond to customer and intermediary self-service and engagement needs.

With COVID-19's significant impact on economic activity and employment levels at a local, regional and global level, consumer spending power has reduced significantly over a short period. Insurers are responding with payment breaks to avoid even bigger problems. Although the tragic loss of life reverberated across society, from an insurance perspective life insurers did not see a large value of damaged liquids of life insurance policies, because the disease most affected older age group, which for the most part did not have life insurance policies. In contrast to the unchanged number of claims settled in life insurance, compared to previous years, a turnaround occurred in the contracting of new policies. The type of insurance that has experienced the massive cancelation is travel and event insurance products due to the restrictions, while the purchase of health care insurances increased because of the thread of getting infected by COVID-19.

The trend that can be highlighted in the insurance market, resulting from both the COVID-19 pandemic and technological innovation, is certainly digitalisation, which has proven to be a key strategic step, but also a heightened need to insure against cyber risks and cessation or downtime. More and more purchases are being done online, as well as customer support processes are digitalized in order to avoid contact because of the pandemic. In Croatia, for example, Uniqa osiguranje d.d. on May 4, 2020, included in the offer a new product for legal entities - Supplementary health insurance due to COVID-19 disease. This insurance is taken out as a group insurance for all employees of the insurance policyholder who are eligible for insurance and includes a one-time payment of the insured amount if during the insurance period the insured stays in hospital for treatment with COVID 19, more than three calendar days. Insurance is taken out without a health risk assessment and without filling health questionnaire. With the arrival of autumn 2020, several new fully digital services appeared in Croatia, and the one that resonated the most was the one called LAQO. (Buljan Barbača, D. and Laća Mrdeža, J., 2021) LAQO is the only 100% digital vehicle insurance and you will not have to sign or show anything here. Different insurance companies have different policies when awarding the first car insurance bonus. The good news is that at LAQO Insurance they give you a maximum bonus of 50% on every first policy purchase, including the purchase of the first car insurance policy in general. If you are interested in the exact price of your first car insurance, you can quickly

calculate it on on line calculator. Croatia insurance claims that the insurance policy can contract in 58 seconds and in case of damage, it will be resolved within 24 hours.

Clients of insurance companies are allowed to conclude distance insurance contracts, electronically, but it should be noted that the termination of contracts concluded remotely is simpler, that is, the contract can be terminated without the policyholder having to give reasons for the termination, as a rule of 14 days from the conclusion, with certain exceptions. The consequence of a unilateral termination is the return of the received premium, which can certainly make planning difficult and cause uncertainty for insurance companies.

One of the great news was announcement of Croatian Financial Services Supervisory Agency (HANFA) from 15 February 2021, which for the first time in history organised the taking of professional exams online. In addition to epidemiological safety, this type of taking it has brought respondents many other benefits, such as faster and easier exams with time savings and no travel costs, the possibility of organizing more frequent exam deadlines and faster publication of exam results. Mobile applications for clients are another big step in the process of digitizing the insurance business, as well as modernizing customer support. The IT sector has made an effort to achieve close cooperation and open teamwork with clients with top solutions. The ultimate goal is to help companies improve their business on mobile and web platforms, while allowing users to enjoy their digital moments. For example, in July 2020, Wiener osiguranje, in cooperation with Undabot, which specializes in web and mobile application development, developed Moj Wiener - a new mobile application for Wiener insurance clients. My Wiener is a self-care type of application, which offers review of active policies and inactive policies in the past year, review of voluntary health insurance cards, displaying promotional messages, receive shelf expiration notifications, possibility of contracting supplementary health insurance, possibility of contracting travel health insurance, reservation of appointments for systematic examinations for beneficiaries of supplementary health insurance and reporting damage under the supplementary health insurance policy. Allianz insurance for every new contracted supplementary health insurance policy, give you free m-Doctor service to private customers for one year. In this app, the doctor responds to your messages 24 hours a day. You can ask your doctor anonymously at any time of the day or night by texting or texting from popular messaging apps. The name and specialization of the doctor who answers your question is always visible, and each question is carefully considered and answered as soon as possible. In the free period, you can consult for free with a limit of one consultation (case) per month. If after the expiration of the free period you still want to use the m-Doctor service, you need to contract the service at a price of 15 kn per month (180 kn per year) and in that case you have an unlimited number of inquiries as long as you are a user.

The need to accelerate digitalisation and increase the scope of virtual operations has also caught up with insurance companies, which need to deliver on transformation plans in the coming year, which would normally be implemented in three to five years. In this sense, the need for innovation and digitalisation for insurance companies was necessary, but a heavy reliance on technology increased exposure to cyberattacks and business disruption. Cybersecurity will certainly be on the list of priorities of insurance companies in the coming period, which is why more investment can be expected in this segment. The transition to the cloud, improving data security and data

processing analytics can be highlighted as priorities for growth and improvement in further business.

3. Analyses of Croatian insurance market trends

Table 1 Number of insurance (in 000) by type of insurance in the period 2011 to 2021

Type of insurance/Year	2011	2013	2015	2017	2019	2021
Accident	2.498	2.452	2.404	2.468	2.713	2.838
Health	92	169	201	354	422	605
Road vehicle	391	364	555	592	703	691
Rail vehicles	0.4	0.2	0.2	0.05	0,07	0.06
Aircraft	0.08	0.1	0.1	0.1	0.2	0.2
Boat	15	17	19	21	26	26
Goods in transport	21	19	17	16	17	10
Fire and natural damage	501	511	526	617	625	756
Other property	580	599	620	619	667	750
Liability for the use of motor vehicles	1.994	2.026	2.688	2.669	2.889	3.350
Liability for the use of aircraft	0.2	0.2	0.2	0.3	0.6	2
Liability for the use of vessels	32	36	40	50	61	63
Other liability	106	127	156	185	224	276
Credit	40	40	33	52	108	93
Guarantee	0.5	0.7	0.7	2	4	3
Various financial losses	29	92	103	132	128	309
Legal expenses	5	6	49	37	28	58
Travel	153	252	437	612	728	818
Life	754	779	798	801	764	688
Annuity	3	2	2	3	4	3
Supplementary ins. with life ins.	540	608	654	640	620	584
Wedding or birth	4	4	3	3	3	2
Life in which the insured assumes the investment risk	55	48	34	47	60	73
TOTAL (non-life)	6.457	6.713	7.849	8.427	9.342	10.647
TOTAL (life)	1.356	1.441	1.492	1.494	1.450	1.349
TOTAL	7.813	8.154	9.341	9.921	10.793	11.997

Source: Croatian financial services supervisory agency & Croatian Insurance Bureau

The total number of insurances in 2021 is 11.996.535, and the share of the number of non-life insurances is 88.75%. 66%, travel insurance 6.82%, fire and natural damage

insurance 6.30%, other property insurance 6.25%, road vehicle insurance 5.76%, life insurance 5.73%, health insurance 5.05% .

Insurance, with a higher number of premiums paid, which have a significant increase in the number of premiums paid in 2021 compared to 2011 are: health insurance with an increase of 560.76%, travel insurance with an increase of 435.83%, road vehicle insurance with an increase 76.95%, motor third party liability insurance with an increase of 68.00%, fire and natural damage insurance with 50.73%, other property insurance with 29.33%.

Although they have a smaller number of insurances, I would also like to point out the insurance of goods in transport and insurance in case of wedding or birth because they have a reduction in the number of insurances by 52.15% and 53.48% respectively.

In some years, the number of certain insurances would increase sharply; In 2014, the number of paid annuity insurance premiums was 20.083.123, and in 2015, 60.901.074. After that, the number of insurances was decreasing. Unlike annuity insurance, the number of paid life insurance policies in which the insured assumes the investment risk doubled in 2016 compared to 2015. Namely, in 2015 the number of insurance was 227.249.245, and in 2016 484.877.980, but after that the number of paid premiums was increasing.

The highest amounts of gross premiums written in 2021 were paid for: motor third party liability insurance in the amount of HRK 2.957.671.436, life insurance in the amount of HRK 2.361.268.894, road vehicle insurance in the amount of HRK 1.405.542.464. The analysis of statistical data in the period from 2011 to 2021 shows a significant increase in gross written premium of credit insurance of 197%, health insurance of 175.70%, life insurance in which the insured assumes the investment risk of 143.33% and insurance of various financial losses of 107.23%.

According to insurance data in 2021, the largest share of gross written premium of 25.24% has liability insurance for the use of motor vehicles, followed by: life insurance with a share of 20.15%, road vehicle insurance with a share of 12.00% , other property insurance with a share of 7.88%, fire and natural damage insurance with a share of 6.91%, health insurance with a share of 6.00%, other liability insurance with a share of 4.51%, insurance against accidents with a share of 4.39% (calculated according to HUO data). The share of total non-life insurance is 75.27%.

According to the analysis of data for 2020 and 2021, the years marked by earthquakes and the COVID-19 epidemic, the largest increase in the share of gross written premium is observed in credit insurance with an increase of 0.86%, life insurance in which the insured takes over investment risk with an increase of 0.62%, liability insurance for the use of motor vehicles with an increase of 0.48%, and a decrease in life insurance of 0.95%, accident insurance 0.50%, road vehicle insurance 0.45%. Total non-life insurance has a share increase of 0.53%.

The total gross written premium for non-life insurance in 2021 amounts to HRK 8.819.981.240, which is 31.37% more than in the previous year, and for life insurance the total gross written premium amounts to HRK 2.897.470.667, ie it is higher by 19.18 % compared to 2020. The total gross written premium in 2021 amounted to HRK 11.717.451.908, which is 28.13% more than the total gross written premium of the previous year.

Table 2 Gross premium (in 000 of HRK) accrued by type of insurance in the period 2011 to 2021

<i>Types of insurance/ Year</i>	<i>2011</i>	<i>2013</i>	<i>2015</i>	<i>2017</i>	<i>2019</i>	<i>2021</i>
<i>Accident</i>	517.410	496.224	477.047	455.823	499.145	514.012
<i>Health</i>	255.147	249.438	329.278	487.840	605.981	703.436
<i>Road vehicle</i>	797.849	662.759	714.287	883.957	1.244.009	1.405.542
<i>Rail vehicles</i>	5.325	6.705	7.100	7.973	1.938	3.245
<i>Aircraft</i>	15.130	8.947	11.105	10.136	9.507	11.571
<i>Boat</i>	205.142	175.886	161.345	148.707	158.864	192.700
<i>Goods in transport</i>	62.120	55.530	39.305	32.464	33.190	34.133
<i>Fire and natural damage</i>	565.981	582.918	566.816	622.887	683.373	809.706
<i>Other property</i>	755.922	669.498	597.795	591.766	768.496	923.806
<i>Liability for the use of motor vehicles</i>	2.935.198	2.978.147	2.101.687	2.049.320	2.260.025	2.957.671
<i>Liability for the use of aircraft</i>	2.565	5.826	7.449	5.310	4.003	4.746
<i>Liability for the use of vessels</i>	36.622	37.844	45.009	38.424	37.966	40.081
<i>Other liability</i>	289.348	309.904	377.078	372.132	468.759	528.309
<i>Credit</i>	130.084	145.950	159.649	194.350	383.123	386.365
<i>Guarantee</i>	7.869	6.245	4.536	7.277	11.536	15.956
<i>Various financial losses</i>	82.690	93.605	118.848	113.735	140.059	171.356
<i>Legal expenses</i>	2.911	2.743	2.588	4.651	5.096	4.285
<i>Travel</i>	46.663	50.016	69.330	95.436	106.251	113.059
<i>Life</i>	2.092.895	2.231.682	2.477.515	2.219.640	2.498.094	2.361.269
<i>Annuity</i>	9.047	11.093	60.901	28.621	11.653	11.071

<i>Supplementary ins. with life ins.</i>	156.469	158.537	146.718	135.282	130.507	122.850
<i>Wedding or birth</i>	8.969	7.601	6.304	5.079	4.281	3.493
<i>Life in which the insured assumes the investment risk</i>	163.888	129.501	227.249	551.592	421.898	398.788
TOTAL (non-life)	6.713.977	6.538.186	5.790.252	6.122.186	7.421.322	8.819.981
TOTAL (life)	2.431.268	2.538.414	2.918.687	2.940.214	3.066.433	2.897.471
TOTAL	9.145.245	9.076.600	8.708.939	9.062.401	10.487.755	11.717.452

Source: Croatian financial services supervisory agency & Croatian Insurance Bureau

Table 3 Number of claims liquidated by type of insurance in the period 2011 to 2021

<i>Types of insurance/Year</i>	<i>2011</i>	<i>2013</i>	<i>2015</i>	<i>2017</i>	<i>2019</i>	<i>2021</i>
<i>Accident</i>	17.445	17.259	16.981	16.129	15.389	12.485
<i>Health</i>	295.159	347.228	1.621.318	2.776.425	4.233.306	4.906.831
<i>Road vehicle</i>	100.969	103.023	106.611	104.270	119.984	109.137
<i>Rail vehicles</i>	255	248	285	354	121	181
<i>Aircraft</i>	11	10	17	17	18	17
<i>Boat</i>	1.450	1.722	1.935	2.008	2.176	1.692
<i>Goods in transport</i>	4.869	4.735	6.079	3.143	1.538	2.857
<i>Fire and natural damage</i>	23.463	28.767	31.527	34.399	32.486	37.078
<i>Other property</i>	85.746	83.566	70.625	73.775	68.860	77.134
<i>Liability for the use of motor vehicles</i>	89.678	78.960	79.533	87.160	97.886	101.066

<i>Liability for the use of aircraft</i>	-	4	2	2	6	7
<i>Liability for the use of vessels</i>	111	92	273	251	499	393
<i>Other liability</i>	10.966	12.749	11.275	12.094	12.690	14.039
<i>Credit</i>	4.064	3.464	3.991	2.210	1.248	1.282
<i>Guarantee</i>	107	408	368	553	795	707
<i>Various financial losses</i>	1.704	1.778	2.678	2.915	2.398	1.855
<i>Legal expenses</i>	3	1	1	16	3	30
<i>Travel</i>	2.742	79.284	161.597	229.857	298.108	358.195
<i>Life</i>	46.929	54.531	48.900	52.223	56.729	62.854
<i>Annuity</i>	342	573	1.606	2.381	2.779	2.456
<i>Supplementary ins. with life ins.</i>	4.302	4.184	3.854	3.195	2.876	2.196
<i>Wedding or birth</i>	234	266	237	191	201	222
<i>Life in which the insured assumes the investment risk</i>	5.215	6.440	6.476	4.504	3.866	6.732
<i>TOTAL (non-life)</i>	638.74 2	763.29 8	2.115.09 6	3.345.57 8	4.887.51 1	5.624.98 6
<i>TOTAL (life)</i>	57.022	65.994	61.073	62.494	66.451	74.460
<i>TOTAL</i>	695.76 4	829.29 2	2.176.16 9	3.408.07 2	4.953.96 2	5.699.44 6

Source: Croatian financial services supervisory agency & Croatian Insurance Bureau

The total number of claims settled in 2021 is 5.699.446, of which 98.69% are non-life insurance. The share of the total number of claims settled in 2021 is health insurance is 86.09%, road insurance 6.28%, road vehicle insurance 1.91%, motor vehicle liability insurance 1.77%, other property insurance 1.35 %, life insurance 1.10%, and the share for every other insurance is less than 1%. A marked increase in the number of claims paid in the period from 2011 to 2021 is noticeable in health insurance and travel insurance. During 11 years, the number of claims paid for health insurance increased from 295.159 to 4.906.831, ie by 1.562.44%, and for travel insurance from 2.742 to 358.195, ie by 12.963.27%.

The total gross amount of settled claims in 2021 amounts to HRK 7.313.606.701, of which the share of non-life insurance is 59.01%. The largest part of the total amount, HRK 2.664.454.440, was paid for life insurance, which is 36.43% of the total gross amount of liquidated damage in 2021. After that, according to the size of the share, there are: motor third party liability insurance with a share of 20.07%, road vehicle insurance with a share of 10.83%, fire and natural damage insurance with a share of 7.75%, other property insurance with a share of 7.37%, health insurance with a share of 4.93%.

During the period from 2011 to 2021, the total gross amount of claims paid for non-life insurance increased by 32.03%, and for life insurance by 130.81%. During this time, the insurance of various financial losses shows the largest oscillations in the amounts of liquidated damages; In 2012, the amount was HRK 16.507.967, and the following year it was HRK 71.646.412.

If we analyze insurance companies and their resourcefulness in the market in these challenging times, significant positive changes in the gross premium written in 2021 compared to 2020 have: Hrvatsko kreditno osiguranje d.d. with a change of 34.67%, Generali osiguranje d.d. s 32.77%, Wüstenrot životno osiguranje d.d. s 24.73%, Wiener osiguranje Vienna Insurance Group d.d. with 22.95%, Adriatic osiguranje d.d. with 22.08%. Only Merkur osiguranje d.d. has a reduction of 1.08% of the value of total gross premium. It should be noted that at Generali osiguranje d.d. the transfer of the entire portfolio was made by Izvor osiguranje d.d. as of 30.04.2020. and Generali zavarovalnica d.d. Zagreb branch as of October 3, 2020. Significant increase in market share in 2021 compared to 2020 had: Generali osiguranje d.d. (1,35%), Adriatic osiguranje d.d. (0,88%) and Wiener osiguranje Vienna Insurance Group d.d. (0,93%) and reduction of market share: Croatia osiguranje d.d. (1,52%), Allianz Hrvatska d.d. (0.44%) and UNIQA osiguranje d.d. (0,35%).

The value of the total gross written premium of Croatia osiguranje d.d. changed from HRK 2.706.913.588 to HRK 2.850.266.561, ie an increase of 5.30%, but the share of this insurance company in the market decreased by 1.52%. Allianz Hrvatska d.d. also had a decrease in market share. of 0.44% and UNIQA osiguranje d.d. of 0.35%.

Table 4 Overview of gross premium charged by insurance companies for the period 01.01.2020. - 31.12.2021.

Insurance companies and reinsurance companies	Total				
	Gross written premium in 000 of HRK		% changes 21/20	share in %	
	year 2020	year 2021		2020	2021
Adriatic osiguranje d.d.	1.001.811	1.223.043	+22.08	9.56	10.44
AGRAM LIFE osiguranje d.d.	388.162	400.355	+3.14	3.71	3.42
Allianz Hrvatska d.d.	1.146.156	1.230.201	+7.33	10.94	10.50
Croatia osiguranje d.d.	2.706.914	2.850.267	+5.30	25.84	24.32
Euroherc osiguranje d.d.	1.341.591	1.482.142	+10.48	12.81	12.65
Generali osiguranje d.d.*	754.197	1.001.311	+32.77	7.20	8.55
GRAWE Hrvatska d.d.	434.033	464.172	+6.94	4.14	3.96

<i>Groupama osiguranje d.d.</i>	33.220	40.317	+21.36	0.32	0.34
<i>HOK osiguranje d.d.</i>	233.443	245.062	+4.98	2.23	2.09
<i>Hrvatsko kreditno osiguranje d.d.</i>	13.079	17.614	+34.67	0.12	0.15
<i>Izvor osiguranje d.d.*</i>	24.547	0	-	0.23	0.00
<i>Merkur osiguranje d.d.</i>	247.844	245.171	-1.08	2.37	2.09
<i>Triglav osiguranje d.d.</i>	549.475	654.057	+19.03	5.25	5.58
<i>UNIQA osiguranje d.d.</i>	575.305	602.319	+4.70	5.49	5.14
<i>Wiener osiguranje Vienna Insurance Group d.d</i>	980.380	1.205.404	+22.95	9.36	10.29
<i>Wüstenrot životno osiguranje d.d..</i>	44.912	56.019	+24.73	0.43	0.48
Total	10.475.070	11.717.452	+11.86	100.00	100.00

As of 30.04.2020. company Izvor osiguranje d.d. made the transfer of the entire portfolio to Generali osiguranje d.d. As of October 3, 2020. Generali zavarovalnica d.d. The Zagreb branch transferred the entire portfolio to Generali osiguranje d.d.

Source: Croatian Insurance Bureau

In the Republic of Croatia, 2020 was marked by two strong earthquakes in the north of the country with great material damage. The first was in Zagreb on March 22, 2020, and the second in the vicinity of Petrinja on December 29, 2020. Earthquakes are still felt today, rarely and much less intense, but the restoration of material damage and the feeling of insecurity in people are still present. As a result, the number of premiums paid in 2020 compared to 2019 increased by 7.44%, and the number of premiums paid in 2021 compared to 2020 increased by 12.55%. The number of paid premiums in 2021 is 755.528. The highest number of reported claims in the last 11 years was in 2020 and amounted to 39.882, and the lowest number of reported claims was in 2011 and amounted to 23.463. The gross amount of claims settled in 2019 was HRK 302.012.434. The value of this amount in 2020 compared to 2019 increased by 70.47% and in 2021 compared to 2020 by another 10.07%.

In the last five years, the number of life insurance premiums has been slightly declining, while the amounts of gross premiums vary in the range from HRK 2.092.895.081 to HRK 2.532.509.810. In the last 11 years, the number of claims paid has reached between 50.000 and 60.000 per year. The gross amount of claims paid is constantly growing over time. In 2011 it amounted to HRK 1.192.943.485, and in 2021 to HRK 2.664.454.440, which indicates an increase of 123.35%. The number of liability insurance for the use of motor vehicles in 2011 was 1.994.069, and in 2014 3.350.054. Since this insurance is mandatory, an increase in the number of road vehicles of 68.00% can be observed. The lowest value of gross premiums written from 2011 to 2021 is HRK 2.008.625.715. The gross premium written in 2011, 2012, 2013 and 2021 is worth around HRK 3.000.000.000. As the number of insured road vehicles increased over time this meant a decrease in the average value of the gross amount of the premium. There was a sharp drop in that value in 2014, when the value dropped from HRK 1.469 to HRK 1.019, and after that the value continued to decrease to HRK 781.

In 2021, the average value of gross premium was HRK 883. During the observed 11 years, the interval of the number of reported damages varies from 75.069 (2014) to 101.066 (2021). The amount of the average gross value of liquidated claims increased from 2018 to 2021 by 17.67%. In the Republic of Croatia, health insurance is compulsory insurance. The analysis of statistical data during the period from 2011 to 2021 shows a steady increase in the number of insurance and gross premiums written, the number of claims and liquidated claims since 2014. The increase in the number of insurance is 263.79%, gross written premiums 152.73%, the number of claims 461.39%, and liquidated claims 130.41%.

The number of claims and the number of liquidations over the last eleven years show a linear increase over time. The number of damages increased by 12.963.27%, and the number of liquidations by 429.54%. A significant decrease in the average value of premiums, a decrease of 33.71%, was observed in 2013 compared to the previous year and in 2015 when the average value of premiums decreased by 18.13% compared to 2014. With the advent of COVID-19, the number of travel insurances decreased by 1.32% in 2020 compared to 2019, and the insurance premium by 4.98%. But as early as 2021, there is an increase in both values. The number of travel insurances increased by 13.87% and premiums by 11.99%. Travels around the world continue.

4. Conclusion

Majority of insurance companies has already turned to post-pandemic growth strategies, often pooling investments in technology that have enabled them to work remotely and collaborate with clients to drive further efficiencies and enable long-term business model upgrades.

As the restrictions on COVID-19 are lifted, many employers, who have enabled their employees to work from home, face the challenge of returning people to the office environment. Most contacts with insured through agents and bookers have had to become virtual due to the pandemic, but with the lifting of the COVID-19 limit many insurers will reassess the value of face-to-face interactions and consider how customer preferences have changed in the long run.

Insurers should certainly implement the innovative approach and operational flexibility adopted during the pandemic to accelerate their transformation into more agile, customer-oriented entities, while striving for higher profitability in terms of new environmental, social and governance expectations. It is important to consider that next generations have a completely different lifestyle in which they are used to immediacy and personalization. For example, millennials do not own cars, flat, or houses anymore. Their trend is to rent all these means. That is why products should be adapted to the new necessities of the market, for example, by creating short-term insurance, temporary products, or international products for digital nomads.

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MECHANISMS FOR PREVENTING AND COMBATING FRAUDS AND CORRUPTION IN ROMANIA TO ENSURE SUSTAINABLE DEVELOPMENT

Nelu Niță

George Bacovia University, Bacau, Romania
nelu.nita@ugb.ro

Marius-Ciprian Bogea

George Bacovia University, Bacau, Romania
bg_cip@yahoo.com

Radu Năfornită

George Bacovia University, Bacau, Romania
radu.nafornita@ugb.ro

Adrian Lupașcu

George Bacovia University, Bacau, Romania
adrian.lupascu@ugb.ro

Abstract. In the current conditions of the globalization process, all the countries of the European Union need changes in the paradigms of supporting the performances imposed by sustainable development, in order to face the new challenges of the XXI century. One of the most important challenges is financial fraud and the corruption associated with it, which is a serious obstacle to any economic growth and, by extension, to sustainable development. This is because, between the level and the way of manifestation of fraud and corruption in any country and the necessity and manner of achieving the sustainable development of that country, there is a strong causal link, corresponding to cause-and-effect links. In this respect, financial fraud and corruption linked to transnational organized crime have the effect of seriously affecting the levels of economic and social development, and the lower they are, the more they support organized crime groups through corruption and fraud, all of which have the main effect of inhibiting performance of any kind and sustainable economic development. This professional study is part of a larger study whose objective is to identify the interdependencies strictly necessary for the consolidation of the rule of law in Romania, as a unique solution to strengthen the guarantees of follow unabated of the road to sustainable development. To begin with, we aim to identify, in relation to the current problems and challenges, the main mechanisms that can underlie the prevention and fight against fraud and corruption in Romania, for the continuous consolidation of performances in all areas of economic and social life and the multiplication of the guarantees for achieving the objectives for the implementation of the 2030 Agenda for Sustainable Development.

Key words: *rule of law; sustainable development; fraud; corruption; prevention mechanisms.*

1. Introduction

The 2030 Agenda for Sustainable Development offers opportunities of fundamental importance for the sustainable development of Romania. However, the context of the political, economic and social evolution of the last 30 years, which has been dominated by bureaucracy, fraud and corruption, does not seem to be favorable to the achievement of Romania's sustainable development goals and targets. In this context,

through this study we try to find the most relevant answers to the questions that bother us the most: “What are Romania’s objectives and targets on the path of sustainable development?”, “Is Romania able to constantly evolve on the path of sustainable development and consolidate its performances?”, “Can bureaucracy and corruption in Romania represent a brake on sustainable development?”, “What could be the mechanisms used by Romania to truly ensure the sustainability of sustainable development?”, “What could be the indications and guarantees that confirm that Romania has a safe path to sustainable development?”

A short historical foray is important for this study, in order to know and understand the political, economic and social evolution of Romania since 1989. This year, through revolutionary violence, Romania came out of communism, its entire subsequent evolution being marked by the system he went through. The new type of freedom and democracy in Romania manifested itself massively through bureaucracy, corruption and the individual appropriation of inherited capital which, under communism, was considered "good of the whole people".

Furthermore, on the new path of freedom and democracy, in Romania there were great inconsistencies and fluctuations in all areas of economic and social life. However, the consolidation of Romania's Euro-Atlantic course was carried out on 29.03.2004, by joining NATO and on 01.01.2007, by joining the European Union (EU). NATO and EU accession were appreciated as fundamental dimensions of Romania's foreign policy.

At present, after 15 years of belonging to the European area of democracy and values, a multitude of problems have still remained unresolved, which have important connections with Romania’s needs for sustainable development, among which we mention:

- *maintaining the Cooperation and Verification Mechanism (CVM)*, which has been established on a transitional basis since Romania’s accession to the EU, thanks to corruption and the non-completion of the justice reform, in order to facilitate continuous efforts to reform the judiciary and step up the fight against corruption. In line with the decision establishing the CVM, it will end when all the benchmarks set are satisfactorily met and without a reversal of the progress made with further action, which has so far not been achieved. In this case, Romania failed, because “some actions of the Romanian state reversed or questioned the irreversibility of the progresses”, which led to eight additional recommendations [1]. The June 2021 CVM report, assessing new progress, notes that Romania has registered a clear positive trend, giving new strong impetus to reform and to remedy the backsliding from the period 2017-2019, so many of the recommendations made are about to be fulfilled, if the pace of progress remains steady [2].

- *Romania’s non-accession to the Schengen Area*, although Romania has committed itself to this through the EU Accession Treaty and although it meets all the technical criteria for joining this area, because there was no consensus at the level of the EU states, as a result of the corruption in the country and the maintenance of the CVM.

- *the non-integration of Romania into the Eurozone and the failure to adopt the European euro currency*, an objective assumed by the same treaty, because not all the convergence criteria established by the Maastricht Treaty on the Stability Pact have not been and are not yet met. In this regard, we consider, first of all, the 5 nominal macroeconomic soundness and stability criteria relating to inflation, long-term interest

rates, exchange rate stability, budget deficit and public debt, which made it impossible to enter the Exchange Rate Mechanism II (ERM II) [3]. The initial targets for the adoption of the Euro were 2014 and 2019, but Romania failed to reach them, so the current target is 2029. Secondly, we are looking at issues relating to the real sustainable convergence in the Eurozone, which have an extremely strong link with sustainable development. From this point of view, Romania is still far from the European average of the EU countries, being usually at the bottom of the statistical rankings, in terms of: poverty, living standards and welfare of the population, income from GDP/inhabitant, labor productivity, competitiveness and healthy economic growth, infrastructures of any kind that are still far behind and, last but not least, in terms of balanced development of all regions of the country and the convergence of national institutions with those in the EU [4]. From our point of view, Romania's sustainable development implies the need for a nominal and real sustainable convergence, in the sense that the progress of a period cannot be seriously canceled by the regresses of the following periods, determined by subjective factors, dependent on the political and state elites that have the effect of lacking political consensus and on objective factors, dependent on crises of any kind and serious slippages in the completion of programs, structural or institutional strategies and reforms, subsequent to those that formed the basis for the implementation of the *acquis Communautaire*, with a view to accession to the EU.

- *serious inconsistencies in respecting the rule of law*, especially in the period 2017-2019, when the amendment of the justice laws in the Romanian Parliament was criticized due to the negative impact on the independence, quality and efficiency of justice. Thus, the implementation of the amended Romanian laws of justice confirmed the previous concerns of the EU bodies, especially since in the years following these changes, other new problems appeared [5]. Currently, as these legislative changes are still in place, concerns about the functioning of the judiciary, in line with the principles and values of the rule of law recognized at European level, still remain topical.

The problems mentioned above, part of many other problems with different levels of relevance in the context of this study, lead us to appreciate, on the right basis, we believe, that the accession to NATO and the EU did not constitute a strong enough anchor for Romania, in the pursuit of clear and irreversible directions of the evolution towards sustainable development and progress.

However, the remediation of the setbacks manifested not so long ago and the positive trends of the new reforms, in the context of the need to achieve the sustainable development objectives in the perspective of the 2030 Agenda, leads us to show optimism, somewhat moderately, regarding Romania's capacity to strengthen the sustainability of the various progresses, due to the still high level in terms of bureaucracy, fraud and corruption in the country.

2. Sustainable development and the new challenges of the XXI century

Nowadays, the concept of sustainable development is widely used, in all areas, in the sense that society, education, health, industry, agriculture, research, resources, etc., all must be sustainable, in order to meet socio-human needs and to provide the resources to optimize the quality of life.

The major challenge of sustainable development is to find ways to encourage environmentally friendly economic activities and to discourage activities that cause environmental deterioration, such as air, water and soil, as well as subsoil pollution [6]. Other challenges of sustainable development must take into account issues relating to demographic and technical coercion, to ensuring intra and intergenerational fairness, to the effectiveness of sustainable development and to the economy of the environment.

Like any large-scale project, sustainable development presupposes an achievable procedural evolution by solving several problems, some of which are common, belonging to the process of development in general, and others are specific such as those related to respect for or non-compliance with the principle of democracy, gender equality, solidarity, respect for the law and fundamental rights, including freedom and equal opportunities for all, etc.

Next, we will try an overview of the main challenges related to the implementation of sustainable development at international and European level.

2.1. International challenges resulting from the UN 2030 Agenda for Sustainable Development.

The 2030 Agenda, as the main international instrument in the field of sustainable development, was adopted by the UN General Assembly Resolution “Transforming Our World” A/RES/70/1 at the UN Summit on Sustainable Development in September 2015 [7]. This agenda has an unprecedented scale and significance, being applicable to all states, depending on their different realities, capacity and level of development, respecting national policies and priorities. The 2030 agenda, to which 194 countries have joined, is an action plan for people, the planet and prosperity, which aims to consolidate universal peace and ensure greater freedom. All countries and stakeholders act on this agenda on the basis of a collaborative partnership, to free humanity from poverty and deprivation, to heal and protect planet earth.

The objectives and targets included in the 2030 Agenda are universal in nature and concern all countries, sustainable development being based on the idea of eradicating all forms and dimensions of poverty, combating inequalities at national and international level, preserving the planet, creating a sustained, inclusive and sustainable economic growth, as well as stimulating social inclusion, all of which are interconnected and interdependent.

The challenges resulting from the 2030 Agenda are related to solving *some of the biggest problems which humanity faces today*, such as the problems related to:

- the billions of people who continue to live in poverty and deprived of a dignified life;
- the enormous differences in opportunities, wealth and power;
- global health threats and frequent natural disasters, which are increasingly intense;
- the aggravation of international conflicts, violent extremism, terrorism and related humanitarian crises leading to the forced displacement of people;
- depletion of natural resources and the negative effects of environmental degradation, soil degradation, freshwater scarcity and biodiversity loss;
- climate change and its negative impact, which undermines countries’ capacity to achieve sustainable development;

In relation to these serious problems of mankind, the challenges of sustainable development of the 2030 Agenda lie in: - the eradication of poverty, including extreme poverty, which is considered to be the greatest global challenge and the indispensable condition of sustainable development; - healing and sustainable protection of the planet and its natural resources; - leaving no one behind on the road to sustainable development, objectives and targets to be achieved for the benefit of all nations, peoples and segments of society; - addressing all outstanding issues, including respect for human rights; - ensuring the balance of the three dimensions of sustainable development: economic, social and environmental; - ensuring sustainable economic growth, taking into account national levels of development and capacities.

In addressing and solving many of these problems and challenges, at a global level, numerous advances have been made in recent years, through the huge opportunities offered by access to education, by the spread of new information and communication technologies, by the application of new scientific and technological innovations in all fields of activity, etc.

In order to solve the mentioned problems and challenges, the 2030 Agenda establishes a set of 17 Sustainable Development Goals (SDGs), corresponding to 169 integrated and indivisible targets, which must be achieved by the horizon of 2030.

The 17 SDGs with the related targets highlight the particular scale of the 2030 Agenda, able to give rise to a new innovative and creative effervescence for sustainable development, perfectly possible to developed Western states, whose capacity to face any challenges is undeniable. Through this study, we try to find a more pertinent answer to the questions we ask ourselves, namely: “Does Romania have the administrative capacity to answer the problems and challenges imposed by the evolution towards sustainable development? Does Romania have the capacity to remove any kind of obstacles in order to achieve the performances imposed by this concept?”

In order to find a correct answer to these questions, we take into account that the performances imposed in this context still seem difficult to achieve in the only 8 years that remain until 2030.

2.2. Challenges for the European Union resulting from the 2030 Agenda.

EU acceded to the 2030 Agenda through the Conclusions of the Council of the EU, adopted on 20 June 2017, entitled “A sustainable future for Europe: The EU's response to the 2030 Agenda for Sustainable Development”, a political document assumed by all EU countries. In this context, EU has been in a leading position from the outset [8] in terms of its contribution to the implementation of the Sustainable Development Goals and Targets of the 2030 Agenda.

From the multitude of problems and challenges of the EU, some very important, which can constitute real obstacles in achieving the objectives and targets set for the horizon of 2030, we believe to be fraud and corruption that manifest themselves in all EU countries, but mainly in the former communist ones, as is the case in Romania.

The EU's great challenge, in our opinion, lies in the actions taken and their effectiveness to prevent fraud and corruption at European level and to face up to all the great challenges known and not yet known, which may be related to calamities,

catastrophes and political, economic and social events that are difficult to anticipate and control.

Fraud and corruption are considered at EU level to pose a serious threat to the security and financial interests of the Union, so protecting these interests is a priority for citizens to have confidence that their money is well spent.

In order to protect its financial interests, the European Union has created several mechanisms, which we are presenting below, in their most essential parts.

2.3. Some EU-wide mechanisms for preventing and combating fraud and corruption.

The EU's mechanisms for preventing and combating fraud and corruption are complex, but in the economics of this study, we mention that they are of a legislative and institutional nature.

a. From a legislative point of view, we mention the regulations regarding:

- *the rule of law mechanism*, which aims to identify any challenges as soon as possible in order to prevent the emergence and aggravation of their problems;
- *creating a link between EU funding and respect for the rule of law*, whereby the granting of European funds to EU states can be made conditional on respect for the principles on which the rule of law is based. In this context, it is necessary to note that problems and disputes over the rule of law have already led to a blockade of Poland's access to 36 billion euros and Hungary's 7 billion euros. The two countries challenged this mechanism before the Court of Justice of the European Union (CJEU), appeal rejected on the 16th of March, 2022, a context in which the EU expects the rapid application of this mechanism;

Added to these regulations is the Commission's Anti-Fraud Strategy (2019), which aims to improve coherence and coordination of the fight against fraud at EU level.

b. From an institutional point of view, we distinguish two important institutions at EU level, which have different roles in preventing and combating fraud and corruption, these being:

- The European Public Prosecutor's Office (EPPO), an institution functioning since the first of June 2021, is an independent EU body, established with the purpose of investigating, prosecuting and indicting the perpetrators of crimes against the EU's financial interests, such as: fraud with EU funds (over 10,000 Euro), cross-border VAT fraud (over 10 million Euro), corruption and money laundering.
- the European Anti-Fraud Office, which operates independently of the European Commission and has the power to investigate fraud, corruption and any other illegal activity affecting the EU's financial interests, as well as to develop anti-fraud policies, while ensuring maximum complementarity of the EPPO, with regard to the effectiveness of on-the-spot checks, inspections, assistance to national authorities, bank account information, admissibility of the evidence collected, anti-fraud coordination services and other coordination activities.

Taking into account the particular importance of the need to protect the EU's financial interests, in our view, the above-mentioned mechanisms, along with many others, are real and comprehensive premises for ensuring that each beneficiary uses EU funds in accordance with their real destination, so that EU states are able to take advantage of all the opportunities offered, for the effective management of the challenges and

difficulties they face in their unswerving evolution on the path to sustainable development.

Following all the opportunities and premises that Romania benefits from, in its capacity as an EU Member State, in the continuation of this study we are trying to find an answer to another important question, namely: Is Romania able to respect the principles of the rule of law and to carry out the programs and strategies in the field of sustainable development? What has Romania not achieved in 15 years since it was a member of the EU, can Romania achieve in 8 years? We hope, through the following analyses, that the answers to all the questions asked will be optimistic.

3. Challenges for Romania of sustainable development

Being a former communist country, with specific mentalities deeply rooted in society and recently entered the EU, after 30 years of freedom and democracy, on its way to sustainable development, Romania faces many complex problems, more or less serious, many of which have already been overcome at EU level, especially in states with a high degree of development. In these circumstances, Romania must already focus on many more problems than the developed countries in the EU, which involves huge time, costs and resources, which, taking into account the existence of various obstacles and obstacles that interpose, may raise questions about the administrative capacity to be solved.

Among the many problems that Romania is still facing, we can mention, by way of example: - the high share of people suffering from severe material deprivation, in relation to the EU average; - the underfunding of the healthcare system and the high incidence of so-called developing countries' poverty diseases; - emigration of a significant part of the highly skilled active population and lack of intentions to return; - lack of access to drinking water and sewerage for most of the rural population, but also of a part of the population on the outskirts of cities; - lack of comfort specific to Western civilization, given that many homes still do not have bathrooms and toilets inside them; - low energy efficiency of many buildings and dwellings, especially the very old ones in a situation of high seismic risk; - the lack of modern transport infrastructures, in particular road and rail which have as major negative effects: extremely low traffic speeds of motor and rail means, low foreign investment in poor regions in the east of the country (due to the lack of motorways and lack of fluidity in traffic), the occurrence of serious accidents with deaths and seriously injured well above the EU average, etc.; - lack of modern technologies and low labor productivity, which do not allow for sustainable economic growth over time, thus contributing to maintaining a high level of poverty among the population, as well as many other economic and social disparities, etc.

The mentioned problems and many others, at a statistical level, place Romania at a much lower level compared to most EU member states and are considered priorities in various national and European strategic documents.

The major and complex problems faced by Romania in the political, economic and social field, education and health, finally materialize in the high degree of poverty and the low standard of living of a large mass of the population, these being due to several obstacles and obstacles that are perpetuated indefinitely, given that the Romanian state seems to be unable to solve them.

Two of the important problems facing Romania, in the current mentality and as a result of the continuous promotion of professional incompetence, which seem unsolvable, which can be insurmountable obstacles, are bureaucracy, fraud and corruption.

The bureaucracy in Romania manifests itself ostentatiously in all public institutions, as a cumbersome and lazy mechanism, with many unnecessary links, which limit initiative and prompt problem solving, which leads to serious deficiencies and dysfunctions, of which all citizens are the victims. It is a well-rounded and protected system, which includes many people based on the political and relational system, whose training and professional competence often do not coincide with institutional needs. Such people only maintain the current state of affairs, from which they benefit greatly, so it seems that there is minimal chance of a significant reduction in bureaucracy.

Fraud in Romania is commonplace. Thus, even from the OLAF Report for 2020, it appears that Romania still has the most irregularities reported as fraud, ranking first when defrauding European funds, at a great distance from other EU countries. In this regard, we must mention here the situation of some persons in positions of high public dignity who, between 2010-2016, came to condition the conclusion of public contracts on the payment of commissions representing percentages between 10% and 30% of their value, the gross amounts obtained fraudulently amounting to tens and hundreds of millions of Euros. Most of these frauds were also based on acts of corruption, which led to a prompt and efficient action of the justice against the great corrupt, an action that was immediately followed by a strong counter-action of the important state institutions against justice, capable of seriously affecting the functioning of the rule of law.

Corruption in Romania existed at a fairly high level at the time of Romania's accession to the EU. This situation led to the establishment of the Cooperation and Verification Mechanism (CVM) as early as 2007, at the time of accession, as a transitional measure aimed at facilitating Romania's sustained efforts to reform its judiciary and step up the fight against corruption. The process of preventing and combating corruption in Romania has been monitored annually at EU level, with the situation assessed on the basis of CVM Reports [9], in order to analyze the progress and establish when this mechanism should be lifted. However, according to the CVM report of the 8th of June, 2021, after 15 years, Romania has not yet managed to meet all the recommendations, so this mechanism has not been lifted, especially as a result of the amendment of the justice laws in the period 2018-2019, in contradiction with the recommendations made under the CVM, the Venice Commission and GRECO. Those amendments to the justice laws, which are still in force, have had a serious impact on the independence of the judiciary, on the quality and efficiency of the Romanian judicial system.

In the context of the above mentioned, the real challenges of Romania generated by the problems and obstacles that interpose in the way of sustainable development, in our opinion, refer to the degree of determination and the capacity of the Romanian authorities at the highest level, to permanently and in a very short time remove the complex obstacles related to bureaucracy, frauds and corruption.

The response given to these challenges, in our view, must be a firm one, based on robust mechanisms and consistently applied for the definitive removal of the causes and conditions that favor these serious deviant phenomena.

4. Mechanisms for preventing and combating fraud and corruption in Romania

The economic and financial frauds, accompanied by corruption, represent the most serious obstacle to the economic development and progress of post-communist Romania. Thus, by diverting resources from the productive results of the national economy, fraud and corruption undermine the efficiency of public spending. Moreover, by the fact that resources are much limited compared to the constantly growing needs imposed by the needs of sustainable development, they seriously undermine the sustainability of public budgets, affecting the investment capacity of the state and territorial administrative units.

Corruption having a special impact on national policies and funds, as well as on those of the EU, in our opinion, an important role in preventing fraud and corruption in Romania can be played, first of all, by three of the European mechanisms, these being:

- *the European Rule of Law Mechanism*, which aims to promote the rule of law and prevent problems from arising or aggravating them, which stimulates interinstitutional cooperation and the identification of any challenges with the mutual support of other Member States, the Council of Europe and the Venice Commission; a special role in this mechanism is played by the Annual Rule of Law Report, which monitors significant positive and negative developments with an impact on the rule of law in the EU Member States; this report covers four pillars, namely: the judiciary, the anti-corruption framework, media pluralism and other institutional issues related to the control system and equilibrium.
- *the European mechanism on financing from European funds* to promote economic growth, job creation, competitiveness, recovery and resilience of states, mechanism through which links are created between EU funding and respect for the rule of law; this mechanism makes the granting of European funds to EU states conditional on respect for the principles underlying the rule of law; as the principles and values of the rule of law reject fraud and corruption, it is expected that Romania will respect these principles and values in order to be able to access and use all the European funds incumbent on it by law;
- *the cooperation and verification mechanism* set up at the time of Romania's accession to the EU, in order to facilitate efforts to reform the judiciary and intensify the fight against corruption; this mechanism will not be completed until all the benchmarks set have been satisfactorily met, which cannot be at all in Romania's favor when it wants to join the Schengen area as soon as possible; from this point of view, Romania has every interest in demonstrating its capacity to fight corruption sustainably, in order to achieve all the objectives, so that based on progress reports, this mechanism, which represents a barrier to accessing other opportunities, is lifted;
- *the European judicial mechanism involving the European Public Prosecutor's Office (EPPO)*, the new independent EU public prosecutor's office; this public prosecutor's office is responsible for investigating, prosecuting and indicting crimes against the EU's financial interests, including several types of fraud, VAT fraud with damages of more than 10 million Euro, money laundering, corruption, etc.; we note that

organizations such as Eurojust, OLAF and Europol support the work of the EPPO, but do not have the necessary powers to conduct such investigations and prosecutions;

The European mechanisms mentioned above, by themselves, are not able to fully solve the problem of fraud and corruption in Romania, in principle, some of them presenting themselves more as a positive factor of pressure and awareness of the state authorities.

The real mechanisms for preventing fraud and corruption are internal in nature, depending on the real causes and conditions of the phenomenon, as they are extremely numerous, starting from the mechanisms of education in the family and in school, to the judicial mechanisms specific to the prevention and combating of these serious criminal phenomena.

In the context of the current realities in Romania, from the multitude of existing mechanisms we intend to mention only those that face various problems in their implementation and application, and without which, in our opinion, it is almost impossible to prevent and combat fraud and corruption, these being:

- *transparency and accountability mechanisms*, which ensure the improvement of the communication process between citizens and the public administration, thus contributing to the reduction of corruption and the increase of citizens' trust in the governing act and the decisions taken by the authorities; in this respect, administrative practices must reach high quality standards by depoliticizing key public service positions and improving the reputation of civil servants; new administrative practices should lead to true models of good practice based on the rule of law, the prevention of conflicts of interest and public scrutiny of the work carried out;
- *mechanisms to strengthen integrity and good governance based on high ethical standards*, leading public officials and leaders at the highest central and local level to make the right choices in the decisions they take, especially in difficult situations and when under pressure; in this regard, we are considering the proper management of conflicts of interest, which is undoubtedly one of the most important principles of ethical conduct; this principle also implies the need to carry out professional duties impartially and objectively;
- *mechanisms regarding the public whistleblower*, for raising awareness and increasing the role of the citizen in the fight against corruption, in order to strengthen the efforts made to adopt proactive attitudes to the signals related to the violation of the laws, to the malfunctions regarding the proper conduct of the activities, so as to ensure the restoration of the public's confidence in the capacity of the institutions to achieve the general interest with professionalism, in conditions of efficiency, effectiveness and economy of the use of available resources;
- *the national judicial mechanisms* through which the effective prosecution of cases of fraud, money laundering and corruption is carried out; in this regard, we are looking at the need for fair trials and the strong application of dissuasive penalties in order to increase their role in preventing and combating these kinds of crimes;

Finally, we appreciate that the correct implementation and application of international conventions and treaties, of national legislation, programs and strategies, including the mentioned mechanisms, is likely to ensure all the necessary conditions for strengthening the rule of law, a fundamental prerequisite in Romania's evolution on the

path of sustainable development and the guarantee of success in implementing its objectives and targets.

5. Conclusions

Many of our opinions and various other conclusions have been formulated during this paper, so in order to draw a final conclusion, we would like to return to a very important aspect noted in the CVM report of June 2021 which, assessing the new progress, notes that Romania has registered a clear positive trend, which gives a new strong impetus to the reform and to remedy the backslidings of the previous period, so many of the recommendations made are about to be met if the pace of progress remains steady.

Taking into account this finding of the European forum, we can appreciate that we should be optimistic about Romania's European path toward sustainable development, so that, with all the slippages that will follow, surely the progress will have positive and undeniable developments.

With all the progress highlighted, in trying to answer the questions formulated during the paper, at this moment we show a moderate optimism regarding Romania's administrative capacity to respond to the problems and challenges imposed by its evolution towards sustainable development. We take into account in this regard the fact that, at present, in Romania there is not yet the degree of determination strictly necessary for the definitive and in a very short time to remove the complex obstacles and barriers they face, including those related to bureaucracy, fraud and corruption, which effectively undermine the achievement of the performances imposed by the concept of sustainable development. Moreover, we appreciate that solving the serious problems associated with the mentioned obstacles makes it difficult to achieve in only 8 years the objectives and targets proposed for sustainable development, given that the performances of the last 30 years, of which 15 years are an EU member, can be appreciated more as modest, in relation to Romania's resources and potential, complemented by the huge opportunities offered in these years by all the European funding funds.

Concluding, we consider that the basis of Romania's constant evolution on the path of sustainable development is the continuation of the consolidation of the rule of law, under conditions of sustainability and irreversibility. In this regard, we believe that, under the influence of the mechanisms developed by the European Union, Romania will become truly able to respect the principles of the rule of law in order to fully benefit from all the opportunities offered, for the efficient management of the challenges and difficulties it faces in its unswerving evolution on the path of sustainable development.

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PROFESSIONAL PAPERS

SOCIALLY ORIENTED BUSINESS MODEL CANVAS: THE CASE OF LIBERATO ASSOCIATION

Stipo Margić, bacc.ing.comp. Applied computing student

University of Split, University Department of Professional Studies, Split, Croatia
stipo@udruga-liberato.hr

Mijo Matijević, Computing student

University of Split, University Department of Professional Studies, Split, Croatia
mijo@udruga-liberato.hr

Laura Lara Gizdić, Trade and tourism management student

University of Split, University Department of Professional Studies, Split, Croatia
laura@udruga-liberato.hr

Ana Bilić, Trade and tourism management student

University of Split, University Department of Professional Studies, Split, Croatia
ana@udruga-liberato.hr

MSc. Ivona Jukić, Senior lecturer

University of Split, University Department of Professional Studies, Split, Croatia
ivona.jukic@oss.unist.hr

Abstract. The goal of modern entrepreneurship is to develop an entrepreneurial climate, which is primarily characterized by an orientation to individual initiative, creativity and innovation, as well as a creative atmosphere aimed at overcoming the existing and creating a new, different and more humane society. In such an environment, social entrepreneurship as a concept, which integrates the creation of economic and social value, has been present in theory and practice for a century. The aim of this paper is to show how social entrepreneurship is developing rapidly and is attracting more and more attention in various sectors. Moreover, it is a specific form of entrepreneurship based on the principles of social, environmental and economic sustainability, which allocates part or all of the generated profit for the benefit of the community. In other words, social entrepreneurship points to the importance of fostering social change. Social entrepreneurs can be defined as people who confront the imbalance that causes neglect and suffering of a part of humanity. With their work, readiness and creativity, they contribute to the betterment of a certain group, and for society as a whole. This attitude guarantees, without a doubt, the further development of social entrepreneurship. An additional motivation for starting a social enterprise can be recognizing the solution to a social problem. In order for a social entrepreneur to achieve his goal, to devise ways to use resources, to structure relationships with stakeholders and to create sustainable values, he must create a business model. So, the purpose of the business model in social entrepreneurship is to discover how the company will generate both financial and social value, and what is the relationship between them. Therefore, socially oriented business model canvas, as an encrypted language for entrepreneurs and business people when sharing, discussing, reviewing and comparing business ideas, is discussed in this paper. Business model canvas is a practical, fast and customizable tool that helps social entrepreneur to understand the complexity of the business from different points of view. This paper also introduces the social enterprise model canvas, on the example of the Liberato association, which creates technical solutions to help people with disabilities throughout Croatia.

Key words: *Social entrepreneurship, Business idea, Socially oriented BMC, Liberato association.*

1. Introduction

In contrast to individual entrepreneurship, social entrepreneurship incorporates creative conceptualization and innovative thinking to spread improvements in a social context. Still, it is a relatively new topic of interest within the academic and the literature on it is limited. The aim of this paper is to show how social entrepreneurship is developing rapidly and is attracting more and more attention in various sectors. Moreover, it is a specific form of entrepreneurship based on the principles of social, environmental and economic sustainability, which allocates part or all of the generated profit for the benefit of the community.

In other words, social entrepreneurship points to the importance of fostering social change and social entrepreneurs can be defined as people who confront the imbalance that causes neglect and suffering of a part of humanity. An additional motivation for starting a social enterprise can be recognizing the solution to a social problem. In order for a social entrepreneur to achieve his goal, to devise ways to use resources, to structure relationships with stakeholders and to create sustainable values, he must create a business model.

So, the purpose of the business model in social entrepreneurship is to discover how the company will generate both financial and social value, and what is the relationship between them. Therefore, socially oriented business model canvas, as an encrypted language for entrepreneurs and business people when sharing, discussing, reviewing and comparing business ideas, is discussed in the following chapters of this paper. At the very end, this paper introduces the social enterprise model canvas, on the case of the Liberato association, which creates technical solutions to help people with disabilities throughout Croatia.

2. What is Social entrepreneurship?

Entrepreneurship is considered to be “one of the most powerful economic forces in the last century, permeating every aspect of business thinking and planning (Kuratko and Hodgetts, 2004)”. The process of entrepreneurship - the transformation of creative ideas into commercially viable businesses - is seen as an ongoing struggle that requires more than a simple approach involving money and luck. Entrepreneurship needs to be viewed as a way of thinking and a set of behaviours that combines risk-taking and planning all future moves.

Although entrepreneurship, as a discipline has been more deeply researched over the last seven decades, social entrepreneurship is a relatively new phenomenon. According to the Social Entrepreneurship Monitor (2005), social entrepreneurs are “a group with a more positive attitude than the general population” and “with less positive attitudes than mainstream entrepreneurs” (Meewella and Sandhu, 2012).

There are several different views on the definition of social entrepreneurship (Škrčić and Mikić, 2007). The first group of scientists refer to social entrepreneurship as a non-profit initiative in search for alternative founding strategies or management schemes, all for the purpose of creation social values. Another group of researchers perceives social entrepreneurship as social responsibility of commercial enterprises involved in

cross-sectoral partnerships, and the third group of researchers sees the term as a means of solving social problems and catalysing the transformation of society as a whole.

One can conclude that there is a growing acknowledgement of social entrepreneurship, on a local, national and international level, in comparison to previous decades where the concepts were less discussed (Defourny and Nyssens, 2010). It is also argued that as social entrepreneurs become more experienced, they seem to become more frustrated with entrepreneurship, see fewer opportunities, are more likely to fear failure and are less likely to see it as a good career choice. Social entrepreneurship is often seen as a secondary term and a less important pathway than commercial entrepreneurship. The main reason for this is that social entrepreneurship is not seen as a good career choice or financially smart opportunity (Meewella and Sandhu, 2012). Regardless, for the purpose of this paper it is important to point out that it is social entrepreneurship, as a link between the private and social sector, that enables application of entrepreneurial principles, such as risk taking, responsibility and innovation, in social sector with the aim of improving the quality of life.

Austin et al. (2006) view social entrepreneurship as an innovative, social value creating activity that can occur within or across the non-profit, business, or government sectors. Zahra et al. (2009) suggest that social entrepreneurship encompasses activities and processes undertaken to discover, define, and exploit opportunities in order to enhance social wealth by creating new ventures or managing existing organizations in an innovative manner. And at last, OECD describes the term social entrepreneurship as the entrepreneurship that has as main goal to address pressing social challenges and meet social needs in an innovative way while serving the general interest and common good for the benefit of the community. In a nutshell, social entrepreneurship targets to social impact primarily rather than profit maximization in their effort to reach the most vulnerable groups and to contribute to inclusive and sustainable growth (Matošević Radić, M. et al. 2020).

Precisely on the basis of the above one can conclude that social entrepreneurship represents the application of entrepreneurial principles, such as: innovation, reasonable risk taking, self-confidence, hard work, clear goal setting and social responsibility sector with the aim of improving the quality of life and at the same time striving to achieve it both financial and social values and as such represents the art of simultaneous realization both, the financial and social returns on investment.

2.1 Who is Social entrepreneur?

The social entrepreneur was defined by Joseph Schumpeter in the first half of the 20th century describing the entrepreneur as an agent of social and economic change implying how entrepreneurs are particularly sensitive to the social environment. As it has been over the last few decades the popularity of the concept of “social entrepreneurship” grew exponentially, so as the number of definitions of social entrepreneur (Škrtić and Mikić, 2007).

One of the most commonly used definitions about social entrepreneur was provided by Dees (1998). He defined social entrepreneurs as change agents in the social sector by: (1) adopting a mission to create and sustain social value; (2) recognizing and relentlessly pursuing new opportunities to serve that mission; (3) engaging in a process

of continuous innovation, adaptation, and learning; (4) acting boldly without being limited by resources currently in hand, and (5) exhibiting a heightened sense of accountability to the constituencies served and for the outcomes created.

Today's conceptual definitions of a social entrepreneur point to the aspiration to create social values using innovative entrepreneurial business models. Potentially the market for these entrepreneurs is huge, as there is a wide range of social needs that remain unsatisfied in existing markets.

The social entrepreneur identifies practical solutions to social problems by combining innovation, available resources and opportunities. In creating social value, these entrepreneurs identify new processes, services and products or unique ways of combining proven practices with innovation in order to solve complex social problems. Whether their work is focused on enterprise development, health, education, the environment, working conditions or human rights, social entrepreneurs are people who perceive these problems and see them as an opportunity to transfer society.

According to Bill Drayton (Dees, 2001), a social entrepreneur should possess the following characteristics: a strong, new idea that can change the system, creativity, "revolutionary" potential, entrepreneurial quality and morale, all in order to realize his vision of society, the vision with which the entrepreneur is connected, until he realizes it, as proven in Liberato case and described in the following chapters of this paper.

2.2 Social entrepreneurship in Croatia

Social entrepreneurship in Croatia is a rather new phenomenon and is still poorly developed. The term appeared in the public discourse rather late, in 2006, and since then has increased to the point where a strategy for social entrepreneurship has been initiated (Matošević Radić, M. et al. 2020). In April 2015 Croatia adopted a *Strategy for Social Entrepreneurship Development in the Republic of Croatia* for the period 2015-2020, which introduced a new definition of social enterprise as "business based on the principles of social, environmental and economic sustainability, in which generated profit is entirely or largely reinvested for the benefit of the community".

Today, one can conclude that theory has not been followed by practical implementation. The present state of the development of the social entrepreneurship in Croatia is reflected in the passive approach towards meeting the Strategy objectives, the lack of institutional infrastructure and legal framework, and the lack of long-term financial support that would ensure stability and planned development of the sector (Šimleša, D. et al. 2019).

At the end again it is important to emphasize the connection between social entrepreneurship and non-profit social organizations that seek to create social value, broadly defined as "meeting basic and long-term needs such as providing food, water, shelter, education and medical services to those in need" (Certo and Miller, 2008). In order for a non-profit to qualify as an actor in social entrepreneurship, income activities must have a strategic long-term orientation with measurable growth and revenue goals. So, the purpose of the business model in social entrepreneurship is to discover how the company will generate both financial and social value, and what is the relationship between them (Sabei, T. et al., 2018). Therefore, socially oriented business model canvas, as an encrypted language for entrepreneurs and business

people when sharing, discussing, reviewing and comparing business ideas, is discussed in the next chapter of this paper on the example of the Liberato association.

3. Socially oriented business model canvas

All types of entrepreneurs need a thorough understanding of their business to ensure long-term success and value to those for whom the business model is applicable. The same goes for associations, non-profit organizations, small and medium enterprises and institutions. The key is to set your idea correctly. Once the idea is created, preparation for implementation and data collection follows. This procedure can also be performed as part of an existing activity within the work of the association or organization because it allows the analysis of the value offered. The main goal of the business model and tool called *business model canvas* is to define the value provided with all the main components that make up a particular business, namely: key partners, key activities, key resources, customer relationships, channels, customer segments, costs structure and revenue streams.

The business model canvas is an approach designed to facilitate the elaboration of ideas and to present data contained in long business plans in a simple way. The creator of this approach is Alexander Osterwalder, who developed it in 2004 and then continued to further create and present a model that can be applied to both for-profit and non-profit organizations (Osterwalder and Pigneur, 2010).

This tool allows you to visualize a business model. It consists of nine parts called “building blocks” within each building block covering one part of an entrepreneurial idea or organization, and the content of the building block is obtained by answering questions that require reflection and research. Completing all building blocks creates an image of the business model described in a logical, innovative and thoughtful way.

The *social enterprise model canvas* (SEMC) was discussed in the research of Austrian professor Sparviero (2019). It is in fact, a business model canvas (BMC) conceived for designing the organizational settings of social enterprises, for resolving the mission measurement paradox, and for meeting the strategy, legitimacy and governance challenges. This type of model is of interest to academics concerned with the study of social entrepreneurship because it offers a new analytical tool that is useful for comparing different forms of social enterprises. Moreover, it is of interest to social entrepreneurs, because the SEMC is a platform that can be used to prevent ‘any kind of challenges. The main features of SEMC that makes it an alternative to the BMC are attention to social value and building blocks that take into consideration non-targeted stakeholders, principles of governance, the involvement of customers and targeted beneficiaries, mission values, short-term objectives, impact and output measures. In the finale chapter of this paper socially oriented BMC for the Liberato association will be presented.

3.1. The case of Liberato association²⁹

The Libetaro association was founded by students at the University department of professional studies in Split, Croatia, in December of 2019 as a reaction to the problems which people with disabilities meet every day.

Noticing how narrow spaces and the lack of adapted passages restrict people with disabilities from accessing basic services on a daily basis, these students came to the idea to facilitate the movement of people with disabilities by developing a digital map that includes all the information about the accessibility of public spaces. They wanted to make routes on the map in order to avoid obstacles and injuries and to increase the quality of life. This is how their first project named LiberatoMap started.

Association Liberato is founded with the idea of creating an interactive information platform to help the most vulnerable in society, people with disabilities, overcome obstacles. The main goal of creating such an application is to encourage adapting an increasing number of objects to the needs of physically disabled people in any form in every city. In this way, the company managers will be influenced to adjust the access to their facilities so that people with reduced mobility can access them like any other visitors.

Members of the association work with the intention of raising public awareness about the importance of working on equalization of opportunities for all in a way that helps people with a disability develop their full potential. It refers to encouraging both measures and actions aimed at removing existing and avoiding new architectural, spatial, and communication barriers in the lives of people with disabilities as well as the improvement of their educational, professional, and social rehabilitation and employment.

Other activities are carried out to encourage and organize social, entertainment, cultural, sports, and other activities to provide support and motivate people with disabilities.

Association Liberato with the help of the University of Split provides an opportunity for students to be included in the work of association projects. Through their participation, they gain productivity, improve their communication, and build teamwork experience. All of these benefit their working skills and it motivates them to apply socially useful knowledge in their future work. Following are short descriptions of products and services of Liberato association.

3.1.1. LiberatoMap

Liberato's first project is now known as the LiberatoMap, an interactive map with information on the accessibility of locations for people with disabilities. This was the first website of this kind in Croatia. The idea was to make routes on the map that are simplified in the way it is easy to enter a new location (objects) on the map, contact information, and image gallery. It includes information about the facility itself, its

²⁹ Sources for this part of the paper are the official website of the Liberato association (<https://udruga-liberato.hr/>), internal documentation of the association and interviews conducted with the president of the association, deputy and other members, from the beginning of 2022 until today.

address, contact number, and more importantly - whether the facility meets the requirements for people with disabilities (with facts about the existence of a ramp, stairs, custom toilet, etc.).

The objects are divided into three categories and presented with traffic lights:

- GREEN light - the facility fully meets the requirements of people with disabilities.
- ORANGE light - the facility partially meets the requirements of people with disabilities.
- RED light - the facility does not meet the requirements of people with disabilities.

The main goal of this map is to increase the number of people with disabilities in everyday activities, primarily young people in higher education. The map became available for the public at the beginning of 2020. The long-term goal for the development and growth of application users and the expansion of the map to all the cities in the Republic of Croatia is that the map includes more and more facilities and information about them. Access to the map is currently available for the cities Split, Trogir, Omiš, and Zadar. During the year 2022, the plan is to expand the map to cities Makarska, Sinj, Solin, Zagreb, Rijeka, Šibenik, and in the more distant future to the whole country.

3.1.2. LiberatoTech

LiberatoTech is conceived as a student project of all study programs with an emphasis on IT/Computing and other technical studies. There is a great demand for workers with advanced IT skills in Croatia, while basic computer skills have become a condition for almost every job that applies. The project consists of 2 parts. The first part is physical which is otherwise hidden from the user and one of the jobs of IT experts is to maintain it so that the end-user did not have any problems. The second part is the virtual one, where students are sitting behind a monitor (without the computer case) and do not know that they are working on the same server.

The project has three priority areas:

- Priority 1: education, professional training, advanced training, and lifelong learning - improving the knowledge of students at the University of Split.
- Priority 2: employment and entrepreneurship - enabling more practical employment after the acquired knowledge on the LiberatoTech project.
- Priority 3: social inclusion and health - with the physical and curriculum design of the project, the beneficiaries can be persons with disabilities.

3.1.3. DisCloud

DisCloud is an interactive digital board that is planned to be placed on frequencies of city locations. It is a solar panel that provides everyone access to LiberatoMap. The panel is adapted the way it is accessible to people with disabilities and blind people. In addition to public use, DisCloud can be repurposed for the user, so it can be placed on outdoor and indoor surfaces, digital maps or any other software required by certain institutions. DisCloud as a product will have two sales models. The first model refers to sales to state and city administrations (model A) and the second way to sales to private customers (model B).

Model A will be donated to cities and city administrations to enable free use for all citizens, and with DisCloud they will receive a free built-in map of the city with locations accessible to people with disabilities. Model B is a source of funding and will be sold to customers at the selling price so it can be used for the purposes buyer wants (reception at the hotel, index in shopping malls, etc.)

The advantage of this project is that there is no alternative on the market. Expectations are that every major city in the Republic of Croatia will have at least 2 DisClouds in public areas whose income will be able to finance this and future projects of the Association. In order to preserve the physical surfaces of public areas, it is achieved that DisCloud is powered by solar energy, so no electrical installations are required during its installation. With any other similar products used for similar purposes (digital advertising), solar power supply was not achieved due to system consumption. With DisCloud, it is achieved the minimum optimal operating conditions for which the power is enabled with solar energy alone.

After placing DisCloud in these public areas, people with disabilities will get a sense of security when moving around the city and a place where they can get all the information about the accessibility of buildings and urban public areas. It is predicted that setting up DisCloud will result in attracting more tourists with disabilities (around 650.000.000 worldwide) so consequently, the project should positively affect general economy as well.

3.1.4. LiberatoTalk

LiberatoTalk is a project related to arranging and coordinating events, lectures, and panel discussions for high school students, university students, and citizens in order to increase the visibility of topics about people with disabilities in a wider social context.

3.2. Socially oriented business model canvas of Liberato association

Finally, in this part of the paper, the BMC for Liberato is presented through the nine building blocks described below and also shown in Figure 1.

3.2.1. Value proposition

Liberato association offers a wide range of products and services for people with disabilities. LiberatoMap is an interactive map of cities that allows people with disabilities to move faster and easier through the application. It was programmed and designed so that users could see objects and locations on the city map and adapt their movement to available content. LiberatoTalk is a project that aims to raise levels of social awareness about the conditions and needs of people with disabilities through various conferences, education, and panel discussions. LiberatoTech is a project that helps people and students with disabilities to adapt to modern technologies and create the conditions for them to access them without hindrance. DisCloud is a digital board that implements an interactive Liberato map on frequent areas in the city where passers-by can access it and find information about the locations they consider to attend.

3.2.2. Customer segments

The segments of service users covered by Liberato projects are primarily people with disabilities, families with children, the elderly, and students. People with disabilities represent one of the most vulnerable groups in society so activities in Liberato are often aimed at them, and the technological solutions offered to them should make their everyday movement easier. Families with children are also an important segment of users due to the use of prams. Older people who are difficulty moving due to various health reasons generate another group of users. Finally, pupils and students are a generation that is yet to become the bearer of social activities and must create public awareness of the problems of people with disabilities and help to solve them.









<p>KEY PARTNERS</p> <p>University Department of Professional Studies</p> <p>University of Split</p> <p>Split-Dalmatia County</p> <p>Youth Council S-D County</p> <p>County Association of the blind Split</p> <p>Association AGAPE</p> <p>Student Council University of Split</p> <p>Next Reality d.o.o.</p> <p>Alliance SUMSI</p> <p>Association Sunce</p> <p>Association TOMS</p> <p>Cities: Split, Trogir and Makarska</p> 	<p>KEY ACTIVITIES</p> <p>Data recording for available and appropriate locations</p> <p>Research and organization of presentations</p> <p>Procurement and installation of equipment</p> <p>Connecting an interactive map and a system to a product</p>	<p>VALUE PROPOSITIONS</p> <p><u>LiberatoMap</u></p> <p>Liberat@</p> <p>Interactive map of cities</p> <p>Facilitating the daily activities of users</p> <p><u>LiberatoTalk</u></p> <p>Liberat@</p> <p>Conferences</p> <p>Increasing social awareness</p> <p>Corporate social responsibility</p>	<p>CUSTOMER RELATIONSHIPS</p>  <p>Modified mobile application for users</p> <p>LiberatoTech engineering solutions</p> <p>LiberatoTalk educations</p> <p>A guide for students with disabilities</p>	<p>CUSTOMER SEGMENTS</p> <p>People with disabilities</p> <p>Families with children</p> <p>Elderly people</p> <p>Students</p> 
<p>COST STRUCTURE</p> <p>Equipment for DisCloud</p> <p>Application development</p> <p>Application maintenance</p> <p>Travel expenses</p> <p>Advertising costs</p> <p>Wages cost</p> 	<p>KEY RESOURCES</p> <p><u>Financial resources:</u></p> <ul style="list-style-type: none"> - own resources - bank loan - EU funds - donations  <p><u>Material resources:</u></p> <ul style="list-style-type: none"> - equipment - current assets/working capital <p><u>Human resources:</u></p> <ul style="list-style-type: none"> - volunteers - members - associates 	<p>CHANNELS</p> <p>Digital marketing</p> <p><u>Social media:</u></p> <ul style="list-style-type: none"> - Instagram - Facebook - Web page <p><u>Media:</u></p> <ul style="list-style-type: none"> - radio - TV - newspaper <p>Web & mobile application</p> 	<p>REVENUE STREAMS</p> <p>Donations</p> <p>Membership fees</p> <p>Advertising revenue</p> <p>EU funds</p> 	

Figure 1 Liberato association BMC

3.2.3. Customer relationship

In the long run, good relations with service users will be maintained by providing project solutions that will be attainable to them for daily use. The customized application where the map is available is free for all users and it is designed in a very simple way for each user. LiberatoTech engineering solutions will enable users to use advanced technologies with the customizations they need for safe service.

LiberatoTalk education will encourage users to attend conferences or even to give a presentation based on their experience on certain topics that might be the subject of

the conference. A guide for students with disabilities is a brochure with information, rights, and obligations that are important for students with disabilities, in order to be familiar with study programs at the University of Split, and also to encourage them to attend college. The guide is also adapted in font type and font size for students with specific difficulties such as dyslexia, dysgraphia, and dyscalculia.

3.2.4. Channels

Communication with service users realizes through marketing activities, social networks, and media. Advertising through radio, television, and newspapers covers segments of service users who are not active on social networks to stay informed in this way about the activities in Liberato. On the other hand, through posts on social media such as Instagram or Facebook and the official website of the Association, a segment of users who are more interested in projects and regularly follow the news will be included. Communicating via the web and mobile apps will connect all service users to a community that can make suggestions for implementing new objects into LiberatoMap and comment on pre-existing location information.

3.2.5. Key partners

Key partners during the implementation of projects are the University Department of Professional Studies, the University of Split, Split-Dalmatia County, Youth Council S-D County, County Association of the blind Split, Association AGAPE, Student Council University of Split, Next Reality d.o.o., Alliance SUMSI, Association Sunce, and Association TOMS. Therefore, the partners are the cities of Split, Trogir, and Makarska, where the Liberato map has been implemented successfully.

3.2.6. Key activities

The key activities important for developing the interactive map are research and data recording about locations available to users and programming a mobile application where users can easily and quickly get all the necessary information about individual places in the city where the map is appointed. The preparation for organizing presentations is crucial so that the conferences could accomplish the most successful outcome, which is to raise awareness about the problems of people with disabilities, and encourage them to continue their higher education. To arrange a conference, it is necessary to find partners and speakers who will participate regularly and successfully. The key activities to reintegrate the DisCloud system are the purchase and installation of the equipment and the general connection of the map and the system to a final product.

3.2.7. Key resources

The required resources are financial resources, material resources, and human resources. The projects will finance from bank loans, EU funds revenues from membership fees, and donations. Material resources for equipment and current assets are necessary to create and maintain the DisCloud system. Human resources are responsible for the planning and implementation of projects. That would be volunteers, members, and partners of the Association who are willing to help in any situation.

3.2.8. Revenue streams

Revenue streams are all revenues generated by donations from cities and partners, membership fees, and funds from European Union through the European Social Fund. Also, additional revenue is possible to achieve by displaying promotional materials on the interactive digital board that is an integral part of DisCloud, due to collaboration with interested partners.

3.2.9. Cost structure

Operating expenses include the costs of all inputs and equipment in the DisCloud production process and the cost related to the development and maintenance of the mobile application. Expenditures also relate to wages and travel expenses associated with location surveys. A large part of the expenditure relates to advertising costs, which are very important to inform the general public about Liberato's projects.

4. Conclusion

Although it is a relatively newer entrepreneurial discipline, social entrepreneurship is experiencing significant development. Insufficient research in this area prevents the adoption of adequate policies for its sustainable long-term development. The key problems that arise in the research are reflected in the very conceptual definition of social entrepreneurship and social entrepreneur, as well as specifics such as the inability to quantitatively evaluate the social benefits that result from the business of social entrepreneurs. However, today one can already conclude that social entrepreneurship acts as a concept that unites the desire to solve social problems and make a profit. In any case, social entrepreneurship can be a significant step in the development of a more humane and tolerant society and socio-economic relations.

Finally, this paper described the importance of understanding business models as well as explained the success of the most used tool for this purpose, the business model canvas. This paper also introduces the socially oriented business model canvas, on the example of the Liberato association, which creates technical solutions to help people with disabilities throughout Croatia. Members of the association work with the intention of raising public awareness about the importance of working on equalization of opportunities for all in a way that helps people with a disability develop their full potential. It is concluded that for the Liberato association the BMC was proven to be a practical, fast and customizable tool that helps social entrepreneur to understand the complexity of the business from different points of view.

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COMPANIES TO MEET THEIR SOCIAL RESPONSIBILITIES

Mercedes Varona Alabern
Florida Universitària, Valencia, Spain
mvarona@florida-uni.es

Abstract. Businesses are entities where individuals work side by side and in coordination, to produce, distribute and sell products or services. There are different stakeholders that make this process possible: a) the entrepreneurs, that without their vision, creativity, passion, endurance and initiative, the businesses would not exist; b) the investors and creditors, who turn said projects into an operating reality; c) the employees, who get the businesses up and running; d) the suppliers, who provide the required materials to produce the products or services; e) the customers, who enable the businesses to become successful; f) a healthy economy, which in turn depends on political and social stability; g) the environment, as a resource provider; h) the community, where the companies operate, and i) the overall society, where the business is immersed. As there are so many stakeholders involved in the success of a business, companies should take all of them into consideration in their daily operations, because their decisions have reciprocating consequences.

On the contrary, when businesses merely seek immediate profits, not only do the rest of the stakeholders endure the aftermath of such decisions, but the company will also experience a long-term negative outcome. The consequences of not supporting all the stakeholders could be classified into the following 3 scenarios: 1- When the company is only seeking its own interests via maximizing profits at any cost, its employees also follow suit, especially the CEOs. They look after their own well-being, thus jeopardizing their company's sustainability; 2- Toxic business environments are created when employees are treated as mere production resources; 3- Companies may produce harmful or useless products, or they may use detrimental manufacturing processes. Different examples of each of the subgroups will be presented in this paper. Finally, the closing remarks shall propose a more socially responsible way of doing business.

Key words: *Corporate Social responsibility; stakeholders; business profits; toxic working environment; sustainability.*

1. Introduction

Businesses are the driving force of the economy in any country. They are the generators of wealth, and therefore resources. Their contribution to society is enormous, as long as they benefit the entire society, and not just a few individuals. However, more often than not, the companies' only goal is to seek a short-term profit, mainly benefiting shareholders. Thus, when companies neglect their social responsibilities, society not only bears the negative consequences of businesses' wrongdoings, but companies themselves will endure a negative long-term outcome.

2. Business today

Businesses are entities where individuals work side by side, and in conjunction to produce, distribute and sell products or services. There are different stakeholders that make this process possible, such as: a) the entrepreneurs, that without their vision,

creativity, passion, endurance and initiative, the businesses would not exist; b) the investors and creditors, who turn said projects into an operating reality; c) the employees, who get the businesses up and running; d) the suppliers, who provide the required materials to produce the products or services; e) the customers, who enable the businesses to become successful; f) a healthy economy, which in turn depends on political and social stability; g) the environment, acting as a provider of resources; h) the community, where the companies operate, and i) the overall society, where the businesses are immersed. As there are so many elements involved in the success of a business, companies should take all of them into consideration in their daily operations, because their decisions have reciprocating consequences. However, when businesses merely seek immediate financial gains, the rest of the stakeholders endure the aftermath of such decisions as do the companies themselves, further explained below:

- When the company is seeking immediate profits at any cost, its employees also follow suit, particularly their executives. They look merely after their own well-being, thus jeopardizing their company's sustainability.
- Toxic business environments are created when employees are treated as mere production resources.
- Companies may produce harmful or useless products, or they may use detrimental manufacturing processes.

2.1 Companies harmed by their executives' excessive ambitions

When companies only seek profits, their employees, particularly their CEOs, will most likely follow suit, harming the companies they lead. Furthermore, when executives' bonuses are only based on the company's bottom line, CEOs are tempted to inflate profits by making high-risk investments, by overstating revenues, or by decreasing product quality or their labor force, which in turn jeopardizes the company's future. These ripple-down effects by CEO mismanagement are illustrated in the following examples:

When recalling the main causes of the worldwide recession of 2008, there are two names that come to mind, Merrill Lynch's CEO Stanley O'Neal (Time Magazine, 2014; NBC News 2007) and Richard S. Fuld Jr., Lehman Brothers' CEO (Lybeck, 2011, p. 119). Both men drove their companies into bankruptcy, being concerned only for their own personal gain. Furthermore, they were responsible for destroying the lives of many families that were dragged into that terrible recession. Nevertheless, both got away with it by receiving generous severance pay of \$150 million and \$158 million respectively. In addition, during his 14-year tenure as the Lehman Brothers' CEO, Fuld accumulated \$466 million. His hourly salary was \$8,320, which amounts to 554 times the average hourly salary in the U.S.A. at that time. Furthermore, Lehman Brothers' and Merrill Lynch's executives pocketed \$1,000 million and \$1,400 million respectively as bonuses, and profited from the sales of their companies' stock just before their collapse. These humongous compensations exceeded the average CEO's salaries by far at that time. In addition, Citigroup's CEO Charles O. Prince (Dash, 2007; Time Magazine, 2014) also prompted huge losses during 2007 with his risky financial speculations. Despite his devastating decisions, he received a compensation in the amount of \$12.5 million that year, along with a retirement amount of \$68 million.

2.2 Toxic business environments

The second effect of putting profits ahead of everything else is the development of a toxic environment in the workplace. Employees are regarded as a mere production resource, which thus harms their physical and mental health, and subsequently affects their work performance and even their families. Indeed, the well-being of the company's employees affects its bottom line. When employees are under stress or are not treated with respect and esteem, their innovation, creativity, motivation, and productivity decrease, reducing the company's ability to succeed (PwC, 2015). On the other hand, a positive, friendly and rewarding environment helps employees be more creative, have better thought processes, and are team players. When people are happy, their brains function extremely well (Goleman, 2014). This is because our brain loves positive and encouraging words. Therefore, our brain works faster when it hears positive comments, resulting in better concentration, creativity, and attention. On the other hand, negative comments, or stress, might reduce an individual's IQ by up to 14 points. Therefore, toxic environments reduce individuals' intelligence (Castellanos, 2017).

However, toxic environments are common in the workplace, either because managers are not properly trained to lead a team, by failing to acquire the necessary competencies to be good leaders, or because they are toxic themselves. The results are catastrophic for the employees' mental and physical health, for their families, and for the company itself.

In 2015, the New York Times published that the corporate giant Amazon mistreated its employees, fostered by Jeff Bezos, the company's CEO (Kantor y Streitfeld, 2015; Stone, 2013). He made a mockery of his employees, while encouraging them to make negative comments behind each other's backs, creating conflict amongst them. After this report came out, Amazon tried to smooth things out, and has been raising their employees' salaries and improving labour conditions since then. Larry Ellison, founder of Oracle (Finkelstein, 2016), also joins the list of CEOs who became very successful by creating a toxic environment in their companies. He was known for insulting and undermining his employees, bragging about his demeaning management style - called MBR - for "management by ridicule". He was forced to resign in 2014.

Wells Fargo (Arnold, 2017) is the fifth largest financial institution in the USA. Nevertheless, they put profits above any other objective, so management followed suit by increasing their bonuses based on the company's bottom line, at whatever the cost. They forced their employees to generate 5 to 20 new accounts every day. Since they could not meet those goals, Wells Fargo's employees started creating counterfeit accounts, by selling products to existing customers without their consent. They created 3.5 million fake accounts, including half a million-car insurance policies, whose owners saw their car repossessed when the unauthorized car insurance payment became past due. Employees who did not comply, or complained about these unlawful practices, were fired and their records were tarnished, thus hampering them from working in any other financial institution.

Chamorro (2020) estimates that up to 50% of managers are incompetent, lacking leadership competencies. He points out that companies become blinded by charismatic individuals that exude self-confidence and self-esteem but are incompetent at their best.

Moreover, Brooks' 2016 research about toxic working environments estimated that 4% to 20% of the CEOs are psychopaths in the U.S.A., in contrast to 1% of the general population. Those percentages are very high and can be comparable to inmates' ratios, which amount to 20%. Other studies lower this percentage to 3% (Bate, Boduszek Dhingra, and Bale., 2014; Ronson, 2012). At any rate, there is a large concentration of psychopaths amongst the companies' CEOs.

In summary, when companies do not follow ethical practices, their employees follow suit. Entrepreneurship is a passion. Yet, when making money is the only motivation to work, the work environment becomes toxic and unpleasant. Furthermore, employees' productivity, creativity and innovation will decrease, driving the company's profits down.

2.3 Manufacturing and marketing products or services that are harmful for society

Purdue Pharma, a U.S.-based pharmaceutical company owned by the Sackler family, launched their prime jewel called OxyCotin, in 1995. This drug is an opioid that has been blamed for causing the opioid drug addiction overdose epidemic that is sweeping across the United States. OxyCotin was marketed to physicians with the false premise that it was not addictive. Some doctors prescribed this drug without being aware of the highly addictive nature to it, causing hundreds of deaths due to overdose. Other doctors prescribed OxyCotin knowing its addictive nature, and showing no regard for the wellbeing of their patients. The Sackler family and the executive directors, along with some of their distributors, were very much aware that OxyCotin is highly addictive. Nevertheless, they continued selling and heavily promoting it to the highest users, the addicts. Now, they are facing numerous lawsuits around the country from states, associations, and other parties. Other pharmaceutical companies joined the moneymaking machines of opioids and they are also facing scrutiny and law suits. (Mariani, 2017; Moghe, 2016).

Table 1: Tax revenues from cannabis business in the State of Colorado

Year	Revenues
2014	\$67,594,323
2015	\$130,411,173
2016	\$193,604,810
2017	\$247,368,473

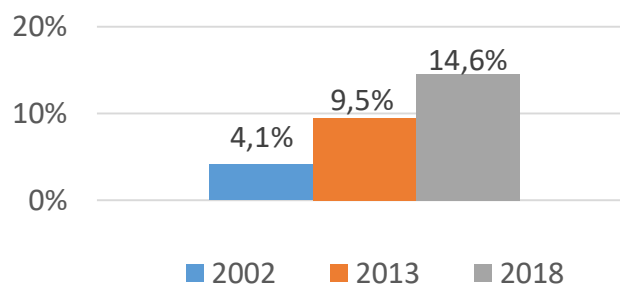
Source: Colorado Department of Revenue, 2019

In the U.S.A., the legalization of cannabis is spreading fast across the nation. Forty-four states (out of 50) have passed laws legalizing marijuana usage in some form. Eighteen states have legalized it for recreational use, and the remaining twenty-six, for medical reasons. The increase on tax revenues and job creation were the arguments used by cannabis advocates (Table 1). Nevertheless, the enormous personal, family and social costs derived from marijuana use were omitted. Indeed, numerous research studies have determined that the cost of consuming marijuana is much higher than the revenues derived from it, especially during adolescence (Volkow, Baler, Compton and

Weiss, 2014). The human brain is the only organ that continues developing approximately 25 years after birth, and marijuana negatively interferes in this process. In fact, cannabis reduces the neuropsychological capacities, increases cognitive problems, produces loss of memory, and may reduce one's IQ by up to 8 points; it could lead to mental incapacitation (National Institute on drug Abuse, 2019). Indeed, new studies revealed that cannabis use is associated with psychotic disorders (Di Forti, et al., 2019). In addition, smoking marijuana increases the risk of having throat and head cancer, extending it to second-hand smokers, such as children (Aldington, S., et al., 2008). Moreover, marijuana increases violence; suicidal tendencies; addiction and so forth, and many of these disorders are permanent (Han, Compton, Einstein, Volkow, 2021; Miller, Ipeku, and Oberbarnscheidt, 2020). Colorado was one of the first states that legalized recreational marijuana, and the effects can be seen in the increase of traffic accidents (Rocky Mountain High Intensity Drug Trafficking, 2020, pp.5-14; Asbridge, Hayden, Cartwright, 2012; Sewell, Poling, and Sofuoglu, 2010), and in hospital emergency treatments related to cannabis (Mycyk and Routsolias, 2021; Monte, Shelton, Mills and Saben, 2019; Roberts, 2019; Rogeberg y Elvik, 2016; Salmore and Finn, 2016). Furthermore, this pattern has been duplicated in other states. Therefore, the cost of substance abuse is very large for the entire society, estimated to be \$3.73 trillion (Recovery Centers of America, 2019).

Despite all these serious side effects, cannabis usage in the USA has been rising fast in recent years, as more states decriminalize it. When an illegal product or service becomes legal, its use increases. Indeed, in 2002 the percentage of adults using marijuana in the U.S.A. was 4.1%. By the year 2013 (Jacob, 2015), it had doubled to 9.5% (two states legalized marijuana for recreational use and several for its medical use) and in 2018 it jumped to 14.6% (Keyhani, et al., 2018), when marijuana use was illegal in only 6 states (Figure 1).

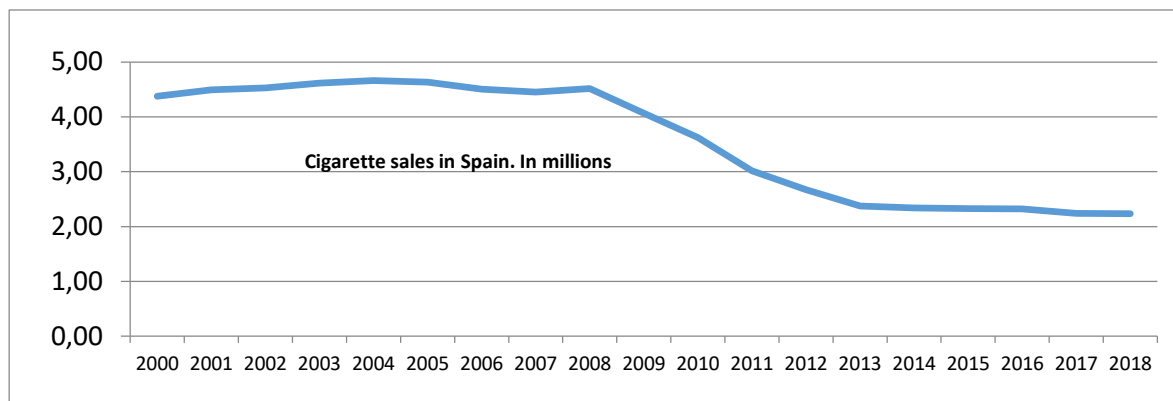
Figure 1. Increase in the percentage of US population that uses marijuana as it becomes legal in most states. 2002-2018.



Source: Author's rendition.

On the other hand, when a product becomes illegal or consumption barriers are put in place, the use of said product decreases. Indeed, Figure 2 illustrates the decrease of cigarettes sales in Spain, due to the 2008 law banning smoking in public places, along with the cigarette price spikes in subsequent years.

Figure 2. Decrease in cigarette sales in Spain. 2000-2018.



Source: Author's rendition based on the Ministerio de Hacienda's data, 2018.

Tobacco firms also produce harmful products for their customers and they spend considerable amounts of money in fighting laws that would reduce their sales, therefore protecting their customers' health. In fact, in the state of Montana, they lobbied to defeat the expansion of Medicaid, which would increase the population with healthcare insurance. In that state, while encouraging smokers to give up smoking, Medicaid is the health insurance program for low-income people in the U.S.A., which are the tobacco industry's customer base. This expansion was financed by increasing taxes on cigarettes sales. (Cates-Carney, 2018). Tobacco companies' profits come with a high price tag for society, exceeding \$300 billion a year in the U.S. (Center for Disease Control and Prevention, 2019).

In the 90s, the American National Rifle Association (NRA) accused a government agency of unfairly targeting gun control. It lobbied aggressively to prevent any restrictions on gun sales, claiming it violated the Second Amendment to the Constitution. Eventually, the NRA was successful in their mission, and in 1996 Congressman Jay Dickey sponsored a bill that prohibited the use of federal funding supporting gun control or gun research. Twenty years later, Dickey regretted his actions because the mass shootings that shocked the nation had not stopped. In 2018, after the Stoneman Douglas High School shooting, Congress lifted the ban on federal research funding gun violence (Rostron, 2018). Homicides in the U.S.A. are high; guns are too easily accessible. The right to bear arms is protected under the 2nd Amendment of the Constitution, resulting in 5 homicides per 100,000 people. This compares to 0.6 per 100,000 people in Spain, (The World Bank, 2021).

Most goods manufacturing has been relocated to Asia countries, due to their low salaries, lack of labor manufacturing protection laws, and lack of environmental regulations. This drives manufacturing costs down, offering low price of consumer goods in the Western World, while the environment is deteriorating. Consumers are tempted to increase their personal spending, putting huge pressure on their finances, and creating a dependency on consumption, with negative effects on themselves and on their families. In addition, the relocation of manufacturing to Asia has led to the destruction of jobs in the Western countries. At the same time, since the manufacturing processes in China had traditionally had little scrutiny overview, many low-quality products are exported, ending up in landfills shortly thereafter. Therefore, the pollution of those products is double. Firstly during the manufacturing process, when environmental regulations are rarely enforced (BBC News, 2017); secondly when they

are dumped into landfills because of their low quality and short life span, or because they are completely unnecessary.

A 2017 research study estimated that 8,300 million metric tons of plastic had been produced to date. All this plastic could cover almost a third of the area of Europe. 79% of this plastic is piling up in landfills or the natural environment. Moreover, 42% of the plastic produced is for packaging, which means that it has an expendable nature. Unless there is a reduction in plastic production, 12,000 million tons (which covers more than the size of Europe) will accumulate in landfills or the natural environment by the year 2050. Plastic is hazardous because it disintegrates and is not biodegradable. Therefore, very small plastic particles end up into the air we breathe, into the water we drink, and into the food we eat, which poses a real health hazard for any living creature, included humans (Geyer, Jambeck and Lavender, 2017).

Disparities in salaries are another disruptive element for steady growth, creating inequality. While the U.S. average salary grew 5.7% from 1978 to 2011, CEOs' salaries increased 725%. At the same time, in 1965, CEOs earned 20 times the average salary, in contrast to 300 times today. In addition, 1% of the American population controlled 42% of total national wealth in 2012, compared to 25% in the 70s, (Mishel and Schieder, 2018). This trend has not waived. For instance, the financial sector, that was responsible for the worldwide economic collapse, still pays their executives outrageous salaries, as illustrated in Table 2.

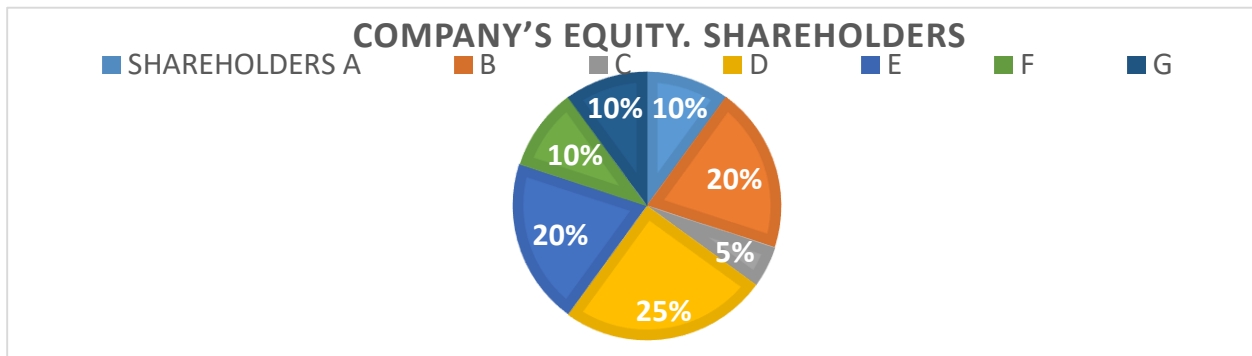
Table 2. CEOs' Salaries in the U.S. financial sector. 2018.

Bank	CEO	Employee	Ratio
Bank of America	\$22,765,354	\$92,040	247:01:00
Bank of New York Mellon	\$9,383,885	\$61,380	153:01:00
Citigroup	\$24,195,749	\$49,766	486:01:00
Goldman Sachs	\$20,662,835	\$136,513	151:01:00
JPMorgan Chase	\$30,040,153	\$78,923	381:01:00
Morgan Stanley	\$16,119,826	\$68,527	198:01:00
State Street			235:01:00

Source: Zarroli, 2019.

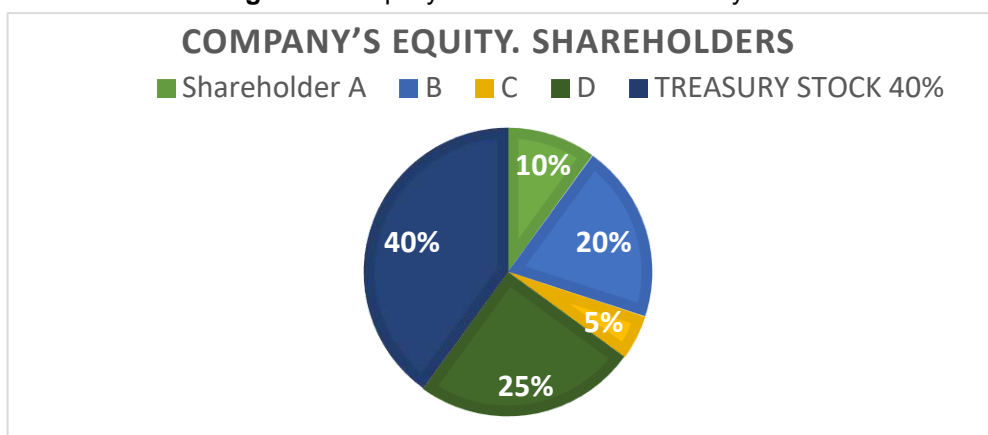
Stock buyback is another common practice in the corporate world. It occurs when corporations purchase their own stock. It favors the shareholders and CEO's because there are fewer outstanding shares, thus creating higher earnings per share. Investors push for stock buybacks because capital gains might be taxed at a lower rate than dividends (if investors are in a high tax bracket). However, companies are depleting resources to purchase its own capital (Figure 3 and Figure 4).

Figure 3. Company's shares before a stock buyback



Source: Author's rendition

Figure 4. Company's share after 40% stock buyback



Source: Author's rendition

3. Possible solutions

The recent great recession of 2008 was a result of the lack of controls over the financial system, combined with greed. Therefore, contrary to popular belief, the economy is not cyclical; people are. During recessions, harsh austerity measures are implemented. However, as the economy improves, controls are lifted. By the time the economy is buoyant again, some essential controls are gone, which in turn sinks the economy into a recession once again. Therefore, good national long-term economic policies are key for a country's long-term growth.

In the previous section, the negative effects of businesses that only sought financial gains were illustrated. As a result, not only were the rest of the stakeholders negatively affected, but companies suffered as well. Thus, a new business model is required to guarantee businesses and society long-term growth,

Furthermore, businesses should try to avoid linking CEO's bonuses to the company's bottom line. This would reduce the risk of general managers inflating revenues artificially, creating toxic environments, increasing inequalities, or reducing product quality. On the contrary, CEO's bonuses could be based on employees' development and growth instead. That would bump up productivity, creativity, and innovation. In addition, businesses could create a positive and productive working environment by reducing salary differences between management and employees. Large salaries and

status differences are economic, social and politically negative. Furthermore, companies should encourage ethical behavior, virtues, motivation, leadership, transparency, teamwork, responsibility, personal and professional development, etc. Moreover, engaging employees in pursuing a higher common goal, one that would benefit others - besides themselves - would improve the company's bottom line. In addition, companies should empower employees with positive reinforcement when they perform their job well (Quinn and Thakor, 2018).

Products and services offered by companies should be positive and useful for society. Companies should be held accountable for the effects of their products on consumers, as well as their environmentally friendly disposal. William D. Nordhaus, recipient of the 2018 Nobel Prize in Economics, determined that companies need climate policy interventions (controls, incentives, etc.) in order to protect the environment and avoid further destruction, since markets do not self-regulate.

Businesses could share the wealth of the company, not only with its shareholders, but also with all its stakeholders. Professor Mazzucato (2018) shares this line of thought by advocating for a new form of capitalism where private and public entities work hand in hand to solve the challenges of our time. When public money is used to subsidize businesses or research projects that benefit companies, administrations should keep a stake in the company and receive a share of those profits. The proceeds from those investments could finance more research and development endeavors.

Paul Romer, the co-recipient of the 2018 Nobel Prize in Economics, determines that ideas and population are what trigger growth in a country. Ideas flourish in educated minds. Therefore, large numbers of educated citizens are the basis for growth. Governments and businesses should invest heavily in education, along with increasing their population, by supporting mothers, fathers, families, and children, in order to succeed. In addition, behavioral economics remind us that people are not as rational as they may think, requiring a helping hand to make the right choices. This demands a positive helping hand from family, friends, professors, books, education, co-workers, society, governments, from positive traditions, customs and religion, etc. Therefore, helping each other and partnering with the government in these goals, along with overseeing them, will improve the economy for everyone.

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TOWARDS A NEW PARADIGM IN THE TOURISM SECTOR THROUGH THE SOCIAL ECONOMY

Dr Mercedes Aznar
Florida Universitària, Valencia, Spain
maznar@florida-uni.es

Abstract. The Secretary of Tourism for the autonomous region of Valencia recently declared that the time has come to plan the end of the great dependencies, i.e., mass tourism from the traditional source markets that has been the historical trend in the Spanish tourism market for half a century. Certainly, the pandemic has been a serious shock for the tourism sector and therefore, the design and implementation of a paradigm shift is needed where the focus should be placed on people and on social responsibility and sustainability. This is the great challenge we face at the moment if we do not want to return to the episodes of tourism-phobia prior to the pandemic, or to the lack of workers due to the precariousness and low quality of employment. In December 2021, the European Commission presented the European Social Economy Action Plan stating that it contributes to the implementation of the European Pillar of Social Rights Action Plan. It emphasises its relevance in terms of its contribution to the GDP of the countries where this type of economy is most developed. This article aims to verify that the social economy has a huge potential to empower young people and women; and in the tourism sector, it can foster the development of new enterprises which, in many cases, can in turn contribute to the local development of depopulated rural areas. In this way, the social economy plays an important role in the creation of quality jobs and also, social and labour inclusion. On the other hand, by enhancing the human factor, the tourist experience becomes emotional and therefore unforgettable, and consequently will be recommended later on in the country of origin. In focusing on local culture, quality and unique initiatives may be developed which, when implemented by the members of the community themselves, may thus become a model that clearly differentiates from impersonal mass tourism. As a result, the sustainable development goals and the fulfilment of the 2030 Agenda are attached the importance they deserve.

Key words: *quality tourism, social economy, inclusion*

1. Introduction

The phenomenon of mass tourism clearly developed during the XX century and reached a peak with the new millennium which led to uncontrolled scenarios of overtourism. This in turn, resulted in certain residents' reactions against this invasion of their hometowns and villages which caused a movement known as tourism phobia, i.e., local citizens unwelcomed foreign visitors not only because they interfered in the smooth development of their daily lives but also, because of their unacceptable behaviour on too many occasions, and the damage to the urban and rural environments. Despite this economic surge, the quality of employment was extremely poor with the sector hiring unqualified workers and offering very low wages. Therefore, it can be argued that the Tourism sector has been advocating for the non-specialization of both the sector itself and its labour market. However, 2020 saw the COVID-19 outbreak worldwide that brought about the collapse of the sector with major losses in tourist revenues and consequently, employment. According to the UNWTO's *Global*

Report on Women in Tourism, women are the most disadvantaged segment, accounting for 54% of tourism employment globally, often concentrated in low-skilled and very low-paid jobs (UNWTO, 2019); consequently, they have been disproportionately affected. In Spain, the percentage rises to 57.8% (Turijobs, 2020) and, similarly, the same problem is observed with -14.7% of wages compared to men. As a result, by the end of 2020, the female unemployment rate had risen to 18.3% (+4% compared to male unemployment), although fortunately 2021 closed with a rate of 15% (+3.2% compared to male unemployment) due to a timid upturn in tourism figures which helped job creation (INE, 2022). However, there is no doubt that the number is still too high.

Sustainability is now the key issue to come out of the economic recession successfully. And although the risk exists that it might become an empty word, as everybody is using the concept as a mantra, there are sectors and, above all, companies that are working seriously towards achieving that goal. In particular, the Social Economy is taking a leading role as sustainability at all levels has always been the core of social enterprises long before the term became trendy. Social sustainability is essential to avoid problems of tourism-phobia or lack of workers in the sector due to precariousness. For this reason, tourism strategy agencies such as those of the Balearic and Canary Islands advocate a commitment to value-based tourism that completely changes their tourism model. On the one hand, circularity is sought in the areas of food, energy, water, materials, mobility, and territory; and on the other, it is fundamental to establish contacts between producers, artisans, hoteliers, and restaurateurs, as well as to put all of them in contact with the tourist. Therefore, natural and cultural heritage, which are the two main assets of European tourism, are highlighted. In this way, their competitiveness is maintained by preserving them. Likewise, supporting circular tourism leads to the adoption of an eco-friendly approach by all stakeholders involved in the tourism activity and also, makes visitors adopt a responsible approach at all stages of their stay, from the preparation of the trip to the local experience.

According to the European Community's report on the *Social Economy Action Plan* (2021), the Social Economy can play a key role in achieving a fair and inclusive recovery from the pandemic, as well as in the green and digital transitions. Social economy organizations create and retain quality jobs and contribute to social and labour market inclusion. This is because they foster sustainable economic development, promote the active participation of citizens, and play an important role in European welfare systems. And the data support this: in Europe there are 2.8 million social economy organizations that generate 13.6 million stable jobs because they put social and environmental purposes first, reinvesting most of their profits in the organization and the rest in the social contribution to the communities where they carry out their business activities. In Spain, the social economy accounts for 48% of employment (CEPES, 2022), where 58.1% of management positions are held by women. The role of women in them is particularly relevant: there are more than 250,000 members in agri-food cooperatives, thus contributing to economic, social, and environmental sustainability in rural areas. But there is also a large number of women members in worker cooperatives (80% are members and 54% occupy management positions). And although we can also find members in consumer and user cooperatives, educational cooperatives, or fishermen's cooperatives, there are no

cooperatives within the Spanish tourism sector that could help to alleviate the disadvantaged situation they have in terms of employment.

As for youth, it is well known that Spanish youth unemployment is among the highest in Europe, i.e., 29.4% ranking second after Greece (EUROSTAT, 2022). For men it is 11.2% and for women 14.3%. What does worse, rural youth represent 4.5% of all Spanish youth (Sevillano, 2022) even though they are key to the future of these territories. And if we add to this the scarcity of young women in rural areas, a serious problem is generated for the sustainability of these environments since generational replacement is eliminated.

Therefore, the objective of this paper is to show how the social economy in tourism can be a supportive factor in the growth and sustainability of rural areas by helping women and youth and thus establish greater roots in their communities. Therefore, a description will be given below of how social economy entities can generate the aforementioned quality and socially sustainable employment; and subsequently, success best practices will be presented to support this hypothesis.

2. Social Economy, sustainable tourism, and rurality

At a time as complicated socially and economically as the one we are living through, the value that the social economy can bring is even more important. It contributes to the achievement of the *European Pillar of Social Rights Action Plan* bearing in mind its three most important objectives for 2030, i.e., that at least 78% of the population between 20 and 64 should have a job; that at least 60% of adults should be benefiting from a training scheme; and a reduction of at least 15 million in the number of people at risk of poverty or social exclusion. And it is here that social economy entities play a fundamental role, as their contribution to GDP is very important, which is why they have been included in the *Proximity and Social Economy Ecosystem*, one of the 14 industrial ecosystems identified in the *EU Industrial Strategy*. By operating in a bottom-up way (a form of democratic and participatory governance) and always being close to communities, citizens and their problems, these entities have the capacity to find and develop innovative solutions. For this reason, the *European Competence Centre for Social Innovation* will be created in 2022 with the aim of replicating successful ideas across the EU.

The close link between the social economy and local communities benefits them in a relevant way, since the objective is always to serve them, for example, by retaining economic activity and income locally. On the one hand, this type of business model contributes to the inclusiveness, resilience, and sustainability of local economies; on the other hand, it promotes short value chains in a way that facilitates local production and consumption and thus supports the circular economy. All this means that social entities can play a decisive role in rural areas as they contribute to their development and, more importantly, prevent depopulation and, as a result, the death of these communities.

Tourism can undoubtedly be beneficial for rural environments because it provides income and enhances the value of the community's heritage. For this reason, gastronomic tourism, wine tourism or oleotourism have meant an enormous contribution of value in certain environments of the European rurality, especially in the Mediterranean slope thanks to the well-known Mediterranean diet, so in vogue now.

This has meant a reevaluation of agricultural work by promoting the specificity of the food experience (Ribas & Mulet, 2018; Gascón, 2019; Medina & Leal, 2018). However, in most cases, the emergence of tourism entails the disappearance of agriculture and fishing due to the reorganization of rural space imposed by government development plans (Gascón & Ojeda, 2014). Moreover, on the Mediterranean coast it is very difficult (not to say impossible) to dissociate tourist activity from real estate with serious implications in terms of mega-projects that use and abuse space, water, and energy (Aledo, 2008). On the other hand, as Blázquez et al. (2011) state, tourism promotes accumulation through dispossession, that is, it has the capacity to radically change, and in a short space of time, the cartography of rural space since the mobility necessary to manage the influx of visitors has led to the construction of numerous large infrastructures.

In summary, tourism can be an economic activity that helps to save rurality, but it is necessary to involve social responsibility in its development and to advocate for sustainable tourism. According to the UNWTO (2005), this type of tourism is defined as the one that takes full consideration of present and future economic, social, and environmental impacts, and that focuses on the needs of visitors, industry, environment, and the host communities. Together with the UNEP (*United Nations Environment Programme*), 12 targets were set that should always lead sustainable tourism: 1. economic viability; 2. local prosperity; 3. quality jobs; 4. social equity; 5. visitor fulfilment; 6. local control; 7. the community well-being; 8. cultural richness; 9. physical integrity; 10. biological diversity; 11. resource efficiency; and 12. environment purity. In other words, sustainable tourism becomes the perfect tool to support rurality and its cultural and natural wealth as well as its traditions.

Other possible terms for sustainable tourism are responsible tourism, which aims to create better places where people can live and visit; or ecotourism, which promotes responsible tourism in natural areas to preserve the environment and sustain the well-being of the local population, all of which through interpretation and education. Other concepts can be found in the literature as green tourism, natural tourism, wilderness tourism, alternative tourism, bio tourism, ethnic tourism, to mention just a few (Martínez Quintana, 2021). The important thing is that in all cases, responsible, respectful, and honest tourism is encouraged. However, the crucial issue here is that the tourism industry cannot survive without sustainable planning and management.

Social responsibility is vital for the sustainability of tourism (Paskova & Zelenka, 2019) and must be based on three fundamental pillars at the individual, local, regional and global levels, i.e., economic, in which the internalization of the economy is imperative; environmental, putting at the forefront a serious analysis of destination carrying capacity as well as an impact assessment; and socio-cultural to, among other things, avoid as far as possible the phenomenon of acculturation that is already having a major impact in numerous rural environments. This last pillar is of great importance since a hospitable local population is a critical factor for tourism development, i.e., the resident influences tourist satisfaction (Sánchez del Río-Vázquez et al. 2019). Therefore, the evaluations carried out by the tourism administration are not enough, as they focus on easily quantifiable indicators that should be complemented with others that are more subjective and, consequently, more difficult to identify in order to discover the perceptions and satisfaction of the local population and tourists. As it is very likely that

both indicators may not coincide on numerous occasions, a qualitative assessment becomes a crucial tool.

2.1 The role of women and youth in rural areas

The woman has been since ancient times the guardian of the traditions in her community and the one who contributed to its survival not only through her work but also, and very importantly, with the upbringing of children. These children became the future residents of that community because they continued to carry out the ancestral tasks associated with rurality, such as agriculture and livestock or fishing. However, the disappearance of this way of life has brought with it the emigration of young people to urban environments, unfortunately in many cases to join the ranks of the unemployed. And women also emigrate and hence, rural populations can be found whose inhabitants are elderly people who cannot contribute to the generational replacement. This can only mean the death of rurality.

With the pandemic, a good number of people decided to emigrate from the city to the countryside because it was identified as a healthier environment. However, in most cases, they have been more of an invasion than a support to the rural environment because their only motivation has been the development of teleworking in a rural area, taking with them the urban culture instead of getting involved in that of the rural municipality where they have decided to settle. There was also a significant increase in rural tourism for the same reason which helped generate income at a time when this meant breathing space for local economies, although it was evident that it was a temporary movement since, as soon as the restrictions ended, the international passenger traffic would start.

According to a report by the Bank of Spain on the problems of depopulation (2021), Spain has a much more serious problem than the rest of the European Union, as 42% of the municipalities are at risk of depopulation (only surpassed by Finland, Latvia, or Estonia in the EU). 80% of the population lives in 20% of the territory and it is an ongoing trend, which is also global as it typifies the most advanced countries where 8 out of 10 inhabitants live in a city with the serious consequences that also arise in urban environments. In the autonomous region of Valencia, the figure is around 20% and between 2001 and 2018 alone, 16.6% of the population was lost; what is more serious, the dependency rate is over 60%. For all these reasons, the Bank of Spain ends its report highlighting among its recommendations the development of rural tourism as a solid solution to the phenomenon of depopulation. In addition, the development of a sustainable tourism strategy in rural areas would eliminate the phenomenon of seasonality. It is evident that to be competitive in the long term, European tourist destinations must adopt all those strategies aimed at distributing demand in a more balanced way in space and time to avoid mass tourism (McCabe, 2017). This was already predicted by Krippendorf (1987) in his analysis of the development and impact of international tourism, stating that the uncontrolled growth of tourist activity could only lead to the emergence of negative effects on the lives of residents in the destination regions. Unfortunately, this prediction was ignored.

Regarding the employment situation of women, the rural labour market is characterised by a low employment rate (which is accentuated in the case of women), low wages, and a marked tertiarization (MARM, 2010). There is gender wage discrimination:

women are over-represented in the wage brackets between €400 and €1,000 while men are over-represented in the €1,001 and €1,400 ones. The rural labour market is also characterised by vertical and horizontal segregation. In terms of vertical segregation, women are generally concentrated in the lower positions of the labour hierarchy and occupy unskilled and clerical positions. Men, however, are much more present in positions of power and responsibility. In terms of horizontal segregation, although for both sexes the service sector occupies the largest share of the population (52.6%), more women (78.5%) than men (41%) are concentrated there. Likewise, women tend to be employed in traditionally female jobs and men in traditionally male jobs. Besides, in rural areas there is a marked feminisation of wage-earning and a masculinisation of rural entrepreneurship and these inequalities between women and men are accentuated as the degree of rurality increases. It is therefore not surprising that the presence of gender stereotypes and roles and their influence on inequalities between women and men show a patriarchal system that is still very present in the rural population. Generally speaking, it is accepted that women play the productive role, as long as they do not abandon the domestic/family role. It is therefore urgent to take measures to help alleviate this serious gap and the situation of women in terms of employment. As a result, some actions are being developed, as is the case of UNWTO with the support of the German Federal Ministry for Economic Development and UN Women. They have launched the *Centre Stage Project* where 4 tourism administrations, 40 companies and 16 NGOs from Jordan, Costa Rica, Dominican Republic, and Mexico are involved. For one year (November 2021-November 2022), actions will be taken to ensure that women's empowerment and gender equality become the backbone of recovery plans in the aftermath of the COVID-19 pandemic. The objective will be to consolidate, coordinate and pool efforts towards gender equality in national tourism administrations and the private sector. Time will tell if this project is as successful as expected.

Regarding the situation of young people in rural areas, the study *La juventud es más que una palabra* (Youth is more than a word), carried out by the Spanish *Network for Rural Development* (REDR, 2022) concluded that encouraging youth entrepreneurship, betting on the digitalisation of the economy or promoting the role of associations to integrate young people in decision-making processes are some of the alternatives that can help guarantee the survival of rural areas and improve the quality of life of rural youth. The complicated situation faced by young people is aggravated in rural areas by endogenous problems such as the ageing of the population and the digital divide. In those cases where the young population has migrated to urban areas, there is a chance to reactivate and promote their return by ensuring their active participation in decision-making processes, through the strengthening of associations and networking. And this is where the social economy can play a fundamental role.

Coinciding with the *European Year of Youth*, the UNWTO held the first global youth tourism summit last summer. Its aim was to bring together children and young people by offering them a platform to share their vision and hopes for the tourism sector. It was one more action within the UNWTO framework to empower youth and tourism as a potential driver for the fulfilment of the 2030 Agenda. The summit concluded with the affirmation that if young people are the future, it is our obligation to give them the necessary tools so that they can empower themselves, become entrepreneurs and, in

the case of tourism, strengthen the sector and, consequently, the communities in which it is developed, particularly in rural environments.

3. Success and sustainability cases

Cooperatives, labour societies, mutual societies, insertion companies, special employment centres, fishermen's guilds and associations are the entities that make up the economic model of the Social Economy. They are all democratic business organisations, based on valuing people and the local environment over capital, in which the benefits of the activity are shared among all members. Their main achievement is the generation of social cohesion wherever they are established due to different factors:

- They are competitive thanks to the employment and stability they generate.
- Because of their collective nature and domestic production, they are capable of solving sectoral or territorial crises. In other words, they remain anchored to the territory in which they were created, which results in its growth and stability over time. This is a source of wealth that prevents, in many cases, the depopulation of territories.
- They are entrepreneurial and participative, values which are fostered among their members.
- They are socially supportive by integrating people with disabilities or at risk of social exclusion into their organisations.

They are therefore a very useful tool for developing the entrepreneurial spirit of women and young people in small rural territories, in an atmosphere of collaboration and solidarity. This in turn helps develop self-esteem and value their own cultural roots.

Globally, cooperatives are not a peripheral trend. More than 12% of the world's population are cooperative members out of the 3 million cooperatives in the world. According to the *World Cooperative Monitor* (EURICSE & ICA, 2022), the 300 largest cooperative and mutual enterprises in the world have a turnover of 2.14 trillion dollars. Furthermore, cooperatives provide employment for 10% of the employed population.

The cooperative model is extremely effective in providing women with a dignified way out of poverty and, often, escape from violence and abuse. The following examples will illustrate this point:

- *GDA Pure Nature*, an agricultural cooperative located in Ain Drahem, Northwest of Tunisia in the governorate of Jendouba. It has 51 active women members, including eight staff members, who have completed professional training in cheese making and received professional certificates. They also produce essential oils, floral waters, and dried herbs. Ethics are at the heart of this cooperative with respect for producers and collectors and their work environment.
- The *Puthukkudiyiruppu D.S Division Women Entrepreneurs' Cooperative Society (PTK cooperative)* in Sri Lanka, the only all-female cooperative in the district dedicated to farming. It has been a way of rising from the ashes and brutality of the war that ravaged that part of the world, where women have no role in society.
- *Abune Gawano* cooperative in Ethiopia, an agricultural cooperative established by women farmers thanks to the joint programme *Accelerating Progress towards the*

Economic Empowerment of Rural Women implemented by the Government of Ethiopia in partnership with UN Women, the International Fund for Agricultural Development (IFAD), the World Food Programme (WFP) and the Food and Agriculture Organization (FAO). In addition, it is supported by the Government of Spain through the Sustainable Development Goals Fund (SDG-F), as well as the governments of Sweden and Norway.

The International Cooperative Alliance (ICA) formed the Youth Network in 2003 to give advice, help and representation to the cooperative youth movement. Young people from all nationalities work together to build fairer and more equitable societies, thus becoming agents of change through this cooperative model of youth social entrepreneurship. Their age facilitates certain attitudinal and behavioural characteristics such as creativity, risk-taking, resilience, adaptation, and a willingness to learn (United Nations, 2020). Since their life expectancy is very high, their interest in the future is also high and therefore, young people are particularly well suited for social entrepreneurship.

There are good practice cases in Spain where residents come together through associations to protect their communities and their way of life. One example is cultural associations that, in addition to protecting their community and its historical heritage, promote rural cultural tourism to survive. This is the case of Oballo in Asturias (northern part of Spain with a high rate of depopulation), a village of only 26 inhabitants where a group of young entrepreneurs have decided to implement distinct actions to attract visitors through their art craft and traditions (particularly, cheese-making); or the case of a village in Soria (on the Spanish plateau, an extremely depopulated area in the country) where, thanks to the efforts of the residents, the demographic trend has been reversed, the number of inhabitants has doubled, and the number of SMEs quadrupled in little more than 10 years. In addition, the ageing rate has decreased and all thanks to the cultural tourism generated around a well-known Celtiberian settlement located there.

These are clear examples of the value of sustainable cultural tourism, understood as a developer of an integrated management of cultural heritage and tourism activities together with the local community to create social, environmental, and economic benefits for all stakeholders involved with the aim of achieving heritage conservation and sustainable tourism development. But this could not be achieved without the participation of the residents. It is them who must promote and believe in their own culture and heritage, encourage participation in all tourism programmes and initiatives, represent their rights to the different tourism stakeholders, and above all, revive their old customs and traditions as a means to achieve on the one hand, safeguarding their heritage (whether tangible or intangible) and on the other, to offer cultural experiences with an important added value. Therefore, the resident as a protagonist in the development of tourism activities is certainly a powerful tool for the common good of the community, attracting the visitor to a personalised cultural experience full of emotion, unforgettable and which they will later recommend.

Three other remarkable Spanish examples where both young women and men are involved are presented below (ESTA, 2022):

- *Ajamon.com* is an online shop of gourmet products created by a 29-year-old engineer in Alustante (153 inhabitants), Guadalajara. He sells all kinds of products

from the area where his office is located, which is also a small logistics management point from where he distributes throughout Spain. This entrepreneur recognises the importance of returning to the village to start up a business, despite the administrative, connectivity and logistical obstacles. However, it involves enjoying nature and a better quality of life and saving time and costs.

- *Huevocón* is a free-range chicken farm dedicated to alternative poultry farming located in Molinos de Ocón (41 inhabitants), La Rioja. Its main value is the guarantee of animal welfare in a peaceful environment that is a Biosphere Reserve. In short, this company is now associated with quality products, exceptional animal care, proximity, and perseverance. Most importantly, it is a group of young entrepreneurs who decided to return to their original rural environments.
- *Anchoas Hazas*, an artisan company dedicated to the traditional canning of Cantabrian anchovies located in Lastres (a village with 4 inhabitants), Asturias. The anchovies from the Cantabrian Sea are caught in the spring, hand-caught, hand-destemmed and preserved in oil to turn them into a gourmet product that adds great attraction to the region. This tradition was developed by women in the past and has now been also taken up by a group of women. Today it is a company that has won awards for its quality and is considered an example to follow not only in the region but also on a national level.

Thanks to the development of these initiatives, these entrepreneurs (and many more) have managed to put the spotlight on their home villages and, as a result, have started to attract visitors to these disadvantaged areas. This in turn has helped to generate other small businesses in the area that provide services in terms of accommodation, catering, local trade, etc. In short, it is reviving villages that were thought to be lost and that are now managing to reverse demographic and ageing trends, as well as generating an economic sustainability that is extremely necessary for the survival of the territories. But always respecting the environment and the culture and traditions of the local community.

Therefore, we must motivate our young students and graduates to be part of this kind of social projects. Surely, they can develop innovative ideas that will help alleviate the tragic situation that rural territories are experiencing and thus become protagonists of sustainable development through tourism and tourism-related enterprises.

4. Conclusions

The tourism sector cannot continue developing the same model it had before the pandemic, firstly, because that model led to an exacerbated mass tourism that brought with it the degradation of tourism and, as a result, tourism-phobia movements; and secondly, because the pandemic has shown that there is a before and after in all economic sectors, and tourism is no exception. Mass consumption must be abandoned in favour of sustainability at all levels, bringing with it the quality product that will revive the industry and create satisfaction among residents and tourists alike. If we add to this the fact that tourism activity can contribute in a decisive way to avoid the depopulation of rural territories, it becomes necessary to change the paradigm towards a model in which the implementation and fulfilment of the Sustainable Development Goals become a reality. In terms of sustainability, ethics and social responsibility, the

Social Economy is the most suitable model for achieving the 2030 Agenda since each of these values is in the very DNA of these organisations.

On the other hand, the pandemic has clearly highlighted the problem of unemployment among women and young people, particularly in rural areas. In Spain the problem is aggravated by the fact that over 50% of tourism jobs are held by women, and a similar situation can be seen among young people. This causes them to migrate to urban environments to the detriment of the rural community, which may end up at serious risk of depopulation. However, the social economy model is presented as a paradigm that helps promote entrepreneurship and, therefore, the empowerment of both women and young people alike thanks to a series of factors that characterise it:

- It provides employment to disadvantaged groups, which can become the lifeline of the rural environment.
- It creates small businesses with limited production that use products at source, thus helping agricultural development among other sectors. In addition, by controlling carrying capacity, they contribute to environmental sustainability.
- A quality brand is generated through the development of craftsmanship and a return to the cultural roots of the community concerned.
- The resident is directly involved in the planning and development of tourism activities, resulting in community satisfaction and increased self-esteem as people.
- Economic and social sustainability is ensured as the income generated by the tourism activity stays in the community. This in turn leads to a demographic and ageing reversal, which is the salvation of the rural territory.
- A unique and quality tourist experience is generated, resulting in tourist satisfaction and thus future sustainability as a livelihood for residents.

If we add to the development of small tourism or tourism-related businesses the creation of small social enterprises for the generation of renewable energy in the villages, we are strengthening the fulfilment of the SDGs. This trend is beginning to emerge strongly and has come to stay thanks to the drive of young, highly qualified entrepreneurs. However, if the public administration does not do its bit by digitising the territories and eliminating bureaucratic obstacles, and with the confidence that national and/or European funds will arrive in due time and form, they will only slow down a process that has already begun in earnest.

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WOMEN AND INCLUSIVE BUSINESS: THE KEY TO ACHIEVING COMPLIANCE WITH THE SDGS IN THE VALENCIA REGION

Dr Johana Ciro

Florida Universitària, Valencia, Spain
jciro@florida-uni.es

Dr Mercedes Aznar

Florida Universitària, Valencia, Spain
maznar@florida-uni.es

Abstract. Inclusive enterprises enable companies to address social challenges and meet the Sustainable Development Goals (SDGs). They represent both a challenge and an opportunity because they foster a more inclusive economy, implement formulas that break with tradition and give way to more creative business models with greater social impact. In terms of meeting the SDGs, they not only contribute to the most obvious ones, such as decent work and economic growth (SDG 8), but also to eradicating poverty (SDG 1), promoting gender equality (SDG 5) and reducing inequalities (SDG 10). The aim of this paper is to identify the keys and real tools that provide an effective response to the complex challenges that society is currently facing and that affect the common good in our time, mainly in the municipalities of the Valencian Community at risk of depopulation and from a gender perspective. In fact, the report *The opportunity cost of the gender gap in the rural world* by the ClosinGap cluster and Caixabank (a Spanish saving bank), frames the collateral damage of depopulation in Spain in the masculinisation of the territory; this is a symptom of the lack of equal opportunities for women in rural areas, so that the female population is increasingly concentrated in a very small number of areas. Likewise, the abandonment of villages by women has to do with the lack of employment and opportunities. This is the reason why it is crucial to ensure employment is attractive and accessible so that their inhabitants, especially women, want to – and can – stay, generating sustainable and inclusive businesses. This article finally shows how the implementation of tools such as inclusive business can provide a solution to these problems and generate alternatives for women living in rural areas with few opportunities. Inclusive businesses seek to generate sustainable economic and business models that multiply the social and environmental benefits in the areas where they operate. Therefore, they are undoubtedly a great economic opportunity for rural territories as they can contribute to wealth and the development of opportunities in depopulated areas.

Key words: rural women, SDGs, inclusive business

1. Introduction

This paper aims to answer the question whether inclusive businesses in depopulated areas of the Valencian Community (eastern Spain) could have a positive impact on women and contribute to achieving the SDGs in the region.

Depopulation on the European continent is a phenomenon whose impact has been evident for several years now, with profound implications for both those who leave and those who remain. The former face phenomena such as job insecurity in medium-sized or large towns, or even in large cities; the loss of the original link with their place of

birth and with it a crisis in their identity (depopulated territories seem doomed to disappear); and social isolation, among many others. They must come to live in territories unknown to them, where the customs of rural life are very different from that in which they have been accustomed to living. For the latter, it implies the fear of the disappearance of the setting in which one's own life takes place; cultural loss; the loss of social cohesion as ties with family and friends are lost; the radical decrease in access to public health, education, and leisure services; and a very low or non-existent access to job opportunities.

Depopulation has had such a harsh impact on rural Spain that for several years now it has also been part of political agendas that seek to curb and mitigate the phenomenon. These aim to create conditions both to prevent it from continuing and to offer options for a dignified life for the people who remain in the territories, through actions that value the local environment and highlight the need to regard existence beyond the urban one. The phenomenon of depopulation has been occurring in rural Spain for several years, but also in other parts of the world. In the Valencian Community, it will be analysed under a differential lens, with a focus on the impact it has on rural women. Their contribution to the maintenance of social, economic, and cultural relations are not valued as they should. Moreover, the same material and spiritual opportunities do not exist for them as for men, and in addition, they are relegated to the roles of reproduction or care (FADEMUR, 2019). This puts more pressure on rural women, forcing them to migrate to urban centres, with consequences such as increasing precariousness, impoverishment, and increased vulnerability (Cruz et al., 2018). For this reason, this paper will analyse the relevance of implementing inclusive business models. A differential approach will be taken in the light of experiences developed in other parts of the world. Special focus will be placed on the process carried out in Latin America, in the department of Valle del Cauca, Colombia, with women from the Nasa indigenous community who managed to set up and consolidate three cooperatives under the legal form of a social enterprise, and which are a source of stable income for them and their families. It is relevant to highlight that these women face a triple condition of exclusion due to their ethnicity, their poverty level, and their gender. In addition, an analysis will be done on the relevance of the implementation of inclusive business as a strategy for mitigating and reversing the negative impacts of depopulation, its relationship with the empowerment of women living in rural areas of Valencia, and its alignment with the 2030 Agenda set out in the Sustainable Development Goals. Lastly, practical cases of inclusive businesses with a differential approach in other parts of the world will be presented. The objective is to offer a broader understanding of the causes and effects of the problem of rural exodus and the relevance of the implementation of strategies with a gender approach to reduce the negative impacts of depopulation.

2. Depopulation and rural women

According to a study on the causes of the depopulation of rural villages (García, 2021), these point to a growing concentration of opportunities to achieve material well-being in urban centres, pushing traditionally rural communities into the dichotomy of precariousness or migration.

Despite the efforts made for some time now by different institutions such as the Valencian regional government, regional associations, and town councils, among

others, no effective solution has materialised that would provide concrete results in the fight to halt the decrease in population density in rural areas (Pinilla et al., 2017). On the contrary, it seems to be becoming increasingly acute, especially after the COVID-19 crisis, when the already complex economic situations of rural communities worsened and they were forced into an urgent search for livelihoods (Observatorio Igualdad y Empleo, 2020).

However, this phenomenon does not affect everyone equally. The situation of rural women is particularly difficult, as the necessary tools for the creation of enabling environments for development are concentrated in cities thus widening the already existing gender gaps (Cruz et al., 2018). For example, in the cultural assignment of roles in the family economic system, greater social prestige and recognition of economic value is given to agricultural activities traditionally carried out by men than to the family work on which the structure of the agrarian economy is based. This is carried out mainly by women, and it is neither recognised nor valued. On the contrary, it is penalised by restricting access to training, employment, or association opportunities, as it requires permanent availability of time. Furthermore, even though women share the work in agricultural activities with men, they are relegated to the most basic activities and with the worst conditions. In addition, their role as a strategic pillar in the rural environment in relation to the creation of socially sustainable governance mechanisms, the care of ecosystems and biodiversity, as well as in the establishment of collaborative work networks that generate shared value, is unknown (United Nations, 2019).

The above synthesises the dreadful gender gaps in rural areas and the differential impact on women, with the consequence of a higher rate of rural-urban migration of women of productive age, who prefer to go through processes of cultural uprooting rather than continue with a model that excludes them from economic and political dynamics. By being marginalised from these contexts, their role is reduced to both reproduction and care for dependents, with immediate implications, but also in the medium and long term. For example, women are not included in the plans to mitigate the impacts of rural exodus to be implemented over the next ten years, nor are there strategies that address the phenomenon in a differential manner and with a real and transversal gender focus. As a result, women are not included in the equation of calculating the potential for sustainable economic growth through, for example, the generation of new jobs or the maintenance of existing ones in dignified and equitable conditions.

Another scenario in which rural women play a leading role is in the preservation of cultural identity and ways of life, as is the case, for example, in the villages of the Community of Valencia. Without due recognition of the enormous value of the role of women in rural areas, it will not be possible to break out of the vicious cycle in which economic and political efforts (centred on policies that do not consider the differential role of women) end up increasing the demographic problem and its negative implications.

Next section will describe how the SDGs are fundamental tools for the inclusion of rural women in the Valencian Community.

3. The SDGs as a roadmap for the inclusion of women in depopulated rural territories of the Community of Valencia

The 2030 Agenda sets out goals that, although ambitious, are encouraging for all human rights defenders, and especially for the most vulnerable and discriminated communities, who trust that their fulfilment will bring them closer to satisfying their basic needs in the coming generations. Having a clear and measurable roadmap is very important, not only because it is a positive exercise for the nations to agree on the main problems to be addressed, but also because it facilitates the definition of a common goal for the regions and sub-regions of the different countries in which the national agendas have not been able to reflect and address their priorities. The SDGs relevance for this analysis lies on introducing an instrument such as inclusive business, as a necessary means to advance in closing socio-economic and gender gaps with special interest in the pressing needs of the hollowed-out villages in rural Spain. To ground the responses in this scenario it is required to narrow down the universe of possibilities in which inclusive business could have a positive impact, so the analysis will focus on five of the SDGs: 1) Poverty reduction; 2) Zero hunger; 5) Gender equality; 8) Decent work and economic growth; and 10) Reducing inequalities. However, the analysis of each of these will be done from the last statement to the first, in order to give a sense of progressivity and successive relationship.

Firstly, a definition will be provided on inclusive business and how it differs from a traditional business. It is worth noting that the concept of inclusion can be applied to the social, political, or economic sphere, and does not refer exclusively to a particular population group but to a set of traditionally vulnerable people and communities. In this paper, the analysis will focus on the inclusion of rural women in the economic and social aspects of their communities. One of the most prominent definitions of inclusive business is that of the World Bank, which defines it as a business promoted by the private sector with a specific focus, i.e., to provide goods and services on a commercially viable basis, with a scalable projection and aimed at low-income communities (World Bank, 2014). The World Business Council for Sustainable Development defines them as sustainable businesses that, while remaining profitable, contribute to poverty reduction by including low-income communities through their involvement in the value chain (WBCSD, 2016). Some social organisations argue that such models must be self-sufficient and environmentally responsible by nature, as they must respond to the fact that low-income groups are the most harmed by the environmental impact of production systems. They must also generate a real improvement in the quality of life of the groups involved in their development (Fundación AVINA, 2010). Another term to be found in the literature is *Full Economic Citizenship* (FEC) to refer to the concept of inclusive business, and which is defined as the inclusion of people living in poverty in the value chain, as producers, consumers, employees, or business partners (UNDP, 2010). The strategy of this type of business is to achieve benefits for the parties involved, and this can only be accomplished with a solid project that allows for economic growth and business sustainability (Báez, 2014).

For the purposes of this paper, inclusive businesses are defined as those conceived as alliances between consolidated companies, which function as anchors, and small enterprises acting as suppliers, distributors, commercial allies, or retailers. Their main objective is to activate or reactivate local economies, generally marginalised or lagging;

to promote short marketing circuits; and to generate collaborative networks in which to recognise the endogenous potential and market opportunities that can be developed, with the necessary technical support. These alliances not only meet the standards of a traditional commercial practice in terms of viability, competition, and profitability, but also arise from the internalisation of existing social and economic imbalances.

Furthermore, they emerge as a response to them in order to compensate for the historical debts of an extractive and utilitarian model with the communities in which it has operated. These compensations manage to transcend the symbolic and transform company-community-consumer relations through the addition of mutual value and the materialisation of shared benefits between the different stakeholders and the ecosystem (CODESPA, 2017). As they are mainly framed in agricultural economies, i.e., at the base of the productive pyramid, they ensure not only operational economic viability but also the sustainability of the territory in which they are established.

The five SDGs to which inclusive businesses relate and their relationship with depopulation and rural women will be presented below.

3.1. SDG 10: Reducing Inequalities

As indicated above, inclusive business is about adding mutual value and realising shared benefits. Some of these benefits usually imply the generation of decent jobs in the value chain for local staff, fair payments and hiring of suppliers, reducing vulnerability to corruption, smuggling, or terrorist financing (Fundación Ideas para la Paz, 2017). It also aims at the development of conservation, compensation, mitigation or environmental adaptation projects or services in the circumstances in which the anchor company operates or the communities with which it interacts. However, it is important to note that these initiatives are not always easy to promote or implement. The natural barriers of a market that does not recognise or compensate for structural inequalities make it difficult to identify opportunities and to set in motion processes such as those proposed here. In addition, they require strong levels of social cohesion and transformational leadership, both individual and organisational (NGOs, aid workers, private sector companies, etc.), which emerge from within. In this leadership rural women have been able to play an outstanding role, as demonstrated in the example of GESTALMUR COOP V, a rural cooperative of social and health care services for people at home, made up of five women operating in Gestalgar, a small town in the interior of the province of Valencia with a population of just over 500 inhabitants. This cooperative provides local services, mainly social and health care for the elderly and dependent people at home, and cleaning services. This is an example of female empowerment, non-conformism, initiative, and effort to improve their work and professional situation. But it is also an example of how the quality of life of an entire town can be improved by public administrations through public-cooperative collaboration.

The implementation of processes and tools in which women actively participate in local economic dynamics will have a quantifiable impact on the reduction of inequalities between men and women in rural areas. These will enable them to have access to income and decent working conditions and, in addition, allow them to participate with an autonomous voice, and vote in decisions that directly or indirectly affect them and their families. It is important to mention that these tools are not conceived from a

paternalistic vision, in which women are only added to, or inserted into, an economic activity. Rather, they recognise and measure their role as managers and architects of their own individual development, and also recognise their environment and the potential to build and multiply collective wellbeing.

3.2. SDG 8: Decent work and economic growth

In view of the above, it can be affirmed that the inclusion of women in the economic growth calculation equation brings enormous surprises, especially when they are understood as active subjects in the economic development of their territories. However, the differences in the working conditions to which they are exposed, especially in rural areas, such as wage gaps, unpaid domestic work, fewer job offers for women and the consequent risk of being forced to accept informal jobs where rights such as access to social security are violated, make it impossible for women to have equal conditions in the labour market to develop their full potential.

SDG 8 appeals to this equality of conditions, understanding that it is a *sine qua non* requirement for all people to be able to participate in adding value, as well as in the returns obtained, within the established structures and outside of them. In this respect, inclusive business models contribute to the equitable distribution of benefits for the parties involved, understanding the different needs of each actor, as well as the multiplying factor that these benefits imply and their returns.

Addressing structural inequalities between men and women undoubtedly requires differential approaches that recognise the diversity of needs, potentials and means available to address them. It is key to understand that the gender approach is not demanded as a cross-cutting issue in order to evidence implementation or mobilise a political agenda. Without its effective application in all dimensions of development it will not be possible to achieve any sustainable results and the promise of leaving no one behind cannot be kept, with the devastating effects this implies for millions of men and women.

3.3. SDG 5: Gender equality

Along the same lines, it is a priority to make decisive progress in the elimination of all types of violence and discrimination against women and girls. However, in the face of the demographic problem in the Community of Valencia, a specific approach to rural women and girls is not contemplated, nor the vulnerabilities to which they are exposed based on their gender. It is because of this that regarding inclusive business as a strategy to advance in closing the gaps between men and women in rural areas is not only pertinent but necessary. Certainly, this does not mean that there are messianic solutions or that the actions taken so far by governments and the different actors involved are unsuccessful. But it does mean that it is essential to design articulated, inclusive, binding, and integral strategies in which women have an active participation. Surely, it will be necessary to make use of tools and methodologies that guarantee the sustainability of the processes.

A clear example achieved through the articulation between actors involved in the fight to stop depopulation in rural areas, where the gender approach has been applied with its binding, inclusive and integral character, is the sanction and implementation of the Spanish *Law on Shared Ownership*, which came into force on 5 January 2012.

Although to date it is far from the initially planned goal of 100,000 women enrolled, the 9,000 women who have signed up are still far from the target of 100,000. Nevertheless, the 935 women registered as of 31 December 2021 (REDR, 2021) now have access to benefits that would have been unthinkable 20 years ago, such as social security contributions and 50% of the income from agricultural holdings.

There are specific demands from different social organisations, who draw attention to the obstacles that women face in practice to access the benefits of the *Shared Ownership Register*. These are, for example, the complex administrative procedures or the low profitability of the agricultural sector. They affect the perception of women's social security payments as an expense rather than a cost and call for a thorough review to implement the necessary changes to ensure that rural women can effectively entry the co-ownership of the land they work. However, it is important to recognise that this was a great achievement of the articulated management between the government and women's rights defenders. Two of the objectives of the law in question were precisely to settle the population in rural areas, promote equality, and improve the quality of life in rural areas. Therefore, it can be affirmed that, once the respective adjustments have been applied, complemented by a strategy to promote inclusive businesses, a measure such as this could have a direct impact on closing gender gaps and the permanence of women in rural areas. It is also important to understand that women produce between 60 and 80% of the world's food and that, according to FAO estimates, if women had the same access to productive resources as men, the production of their farms would increase from 20% to 30% (FAO 2011).

3.4. SDG 2: Zero hunger

Beyond the cultural and economic implications of depopulation, it is imperative to solve the hunger of men and women who live in the countryside. This will ensure that there are people willing to cultivate the land who, in turn, feed the world with the fruits of their labour and contribute directly to the fulfilment of this goal. It cannot be ignored that around 821 million people in the world today suffer from hunger, especially affecting children (FAO 2020). This requires making available more efficient resources. Women have shown that they can do this if they are guaranteed access to the same productive assets and the same rights as men.

Therefore, it is not only relevant but also timely and coherent to refer to partnerships between anchor companies and rural communities, especially rural women, that develop the endogenous potential of the territories and generate opportunities to add shared value and equitable distribution of benefits. As a result, women are encouraged to stay in, or return, to rural areas. In the long term, this will influence the dynamization of local economies and the extension of benefits to communities that are less geographically proximate. As a result, multiplying benefits will be transferred to more people in conditions of vulnerability. However, for this to happen, one of the premises is to broaden the horizon in which results are expected and to trust in the potential of women to create individual and collective wellbeing.

3.5. SDG 1: Poverty reduction

The sum of all the efforts outlined throughout this analysis might facilitate the necessary means for structurally disadvantaged people to self-manage their economic

development. These will undoubtedly lead to progress in closing gaps and reducing poverty (SDG 1), one community at a time.

It can be concluded then that inclusive business is one of the most powerful tools currently available, which, together with other measures that create enabling environments, can respond to the effects of rural-urban migration in the Community of Valencia. Its methodological comprehensiveness can have positive impacts on all dimensions of development on a human scale (Max-Neef, 1993), on the one hand; and on the other, collectively and in the long term, it can have an impact on the indicators of population growth rate, ageing index, migration rate, or contribution of the rural economy to GDP, among others.

Below, a description will be provided on how inclusive businesses respond to social problems and provide a tool for economic, social, and environmental sustainability for rural women, thus generating a positive impact complying too with several of the SDGs.

4. Best Practices Samples

This section will present three successful case studies (Casado et al., 2018; Ciro, 2017). Special emphasis will be placed on the case of the three cooperatives created by the women of the Nasa indigenous council in Cali (Colombia), from the DES methodology.

4.1 *Supracafé*: Inclusion through the innovation in coffee production

- Inclusive business typology: Inclusion of vulnerable groups, especially women, in the value chain.
- Social challenge: Poverty and vulnerability of women and displaced families.
- Beginnings: in 1986 its founder had the opportunity to do an internship in Colombia with the Federation of Coffee Growers. With the knowledge he acquired about the dynamics of this industry, he started a business to sell high quality coffee that would also benefit small producers. To this end, he partnered with the Colombian exporting cooperatives in 1990. Later, in 1999, through one of these cooperatives located in the Cauca region, he had the opportunity to meet a group of women, victims of forced displacement, who needed to support their families. As a result, a project for the inclusion and strengthening of suppliers was drawn up whereby part of the income generated by the company was allocated to these women. Since then, the assistance has not stopped.

Supracafé's impact has been to help found associations so that women can generate greater added value in coffee production and thus obtain a higher level of income. Thanks to these, they have been able to register their coffee as organic and, in addition, clean energies have been introduced in part of the production processes. Moreover, social and environmental responsibility is shown in continuous improvement processes of the Occupational Health and Safety, Environmental and Quality Management systems. Part of its supply chain is in the Cauca region where many women are involved in coffee cultivation and sell their production to *Supracafé*, thus being regarded as strategic partners.

The consolidation of women as suppliers within the cooperative associations generates value and provides an economic livelihood for displaced women. One of the

key strategies is to integrate sustainability as an important part of value generation in the strategic plan.

4.2 *Divina Pastora*: Commitment to an inclusive economy

- Inclusive business typology: inclusive services for vulnerable groups.
- Social challenge: Economic insecurity of vulnerable groups, especially women in the domestic services sector.
- Beginnings: It was founded in 1957 with the aim of providing welfare and security benefits to domestic service workers who at that time had little social protection. Two years later, it already had over 10,000 members thanks to a group of domestic workers who started to inform other workers about the benefits of membership.

With the mission of social welfare and aid or assistance for its members and their assets, and with more than 400,000 members and 60 offices throughout Spain, *Divina Pastora* has become the leading Spanish mutual insurance company. Its general operations bring benefits to its mutuals and customers due to the quality of its services and a good price and coverage relationship. The innovation in their business model consists in promoting the cause of a more inclusive economy.

4.3 Three indigenous women's cooperatives, Nasa council in Cali (Colombia)

As convincing evidence of the leading role played by women in preserving the cultural identity of their communities, this paper presents the process carried out in Latin America, in the department of Valle del Cauca, Colombia, with women from the Nasa indigenous community. These managed to set up and consolidate three cooperatives under the legal form of social enterprises. They are a source of stable income for them and their families and an effective strategy for dealing with the conditions of exclusion to which they are exposed due to their triple condition of vulnerability, i.e., their poverty, their ethnicity, and their gender. They also rescue the cultural expressions of the idiosyncrasy of their councils through the production and promotion of identity-laden products, such as traditional weavings and corn derivatives, as chicha, an ancestral drink for this community.

This process was developed as part of a pilot programme in 2016 for the application of the *Differential Empowerment Strategy* (DES from now on) methodology (Ciro, 2017), i.e., a dialogue of knowledge for co-creation based on cultural identity. It proposes to address economic and social gaps in a comprehensive, inclusive and gender-focused manner, using the conceptual framework of local development and social innovation from the principles of epistemic justice and ecology of knowledge as a lens.

The following qualitative research techniques were used to carry out this pilot project: review and analysis of documentary material, in-depth interviews, life stories, participant observation, and updating of the census and social innovation methodologies such as, Expert Workshop, Citizen Coffee Workshop, and the Pilot Programme *Differential Entrepreneurship for the Empowerment of Nasa Women*. It was an entrepreneurial project launched among 20 women of the Nasa council who thought, developed, and structured their social enterprise projects from the cultural identity, based on their own knowledge and the traditions of their people to promote their economic autonomy. The proposal included training them in the fundamentals of

social entrepreneurship, from the ideation phase to the structuring of the business plan. Working groups were formed in 3 cooperatives:

1. *Las Gaitanas*: weaving of unique garments that preserve the ancestral identity of the Nasa people.
2. *Empanadas Sol Nasa*: elaboration of fast food based on traditional elements of the gastronomy of the Nasa people.
3. *Chicha El Maíz*: production and distribution of this ancestral drink, with the best quality maize.

The DES methodology enabled to verify that the creation of scenarios in which importance is given, and economic value is generated, to the work of preservation of cultural identity developed by the women of the Nasa community, has had a positive impact on the self-perception of themselves as protagonists of their reality. Furthermore, it has reconnected them spiritually with their traditions and has allowed them to contribute to their community materially and culturally. As well, it has aided to improving relations between them and generating collective strengths, based on the empowerment engendered from the physical, emotional, and economic autonomy. As a result, the differential empowerment pilot programme allowed them to overcome one of their biggest problems in relation to economic sustainability, i.e., to generate a stable income. In addition, it is important to highlight that a legal form for the creation of a social and solidarity-based enterprise was achieved through the cooperatives, in harmony with the ideals and principles of the ancestral community, based on cultural values.

The innovation in the business model was to generate cooperation and strategic alliance between the actors. In response to this, one of the good results of this experience was an agreement with the Mayor's Office of the Municipality of Santiago de Cali, Colombia, from 2016 to 2019 whereby the indigenous products and cultural identity of these cooperatives were made visible and consumed in the events and activities of their institutions.

5. Conclusions

Although the origin of inclusive business was more associated with work in developing countries and in the market at the base of the pyramid, the interesting thing about the concept is that it is also applicable to developed contexts, where the same situation of vulnerability does not exist, but where enormous social challenges and inequality persist, as is the case of women in the Valencian Community. This approach is a more creative and high-impact tool for resolving the social challenges posed by the lack of opportunities faced by rural women and, in turn, for contributing to the SDGs and, specifically, to the challenges of vulnerability and poverty in the environment with which they interact. It is therefore a matter of installing entrepreneurial capacities at the service of an economy that generates prosperity for all people.

A rural outlook must be incorporated into policy and legislative proposals. This perspective must enable to identify the differential impacts, especially for women, leading to the implementation of tools such as inclusive business in an appropriate manner, providing a real impact on the fulfilment of the SDGs.

The creation of inclusive businesses is encouraged, thanks to the collaboration between rural cooperatives and other more powerful external companies that allow

them to reach rural areas without the need to establish themselves in person and generate synergies in resources and services. The case studies of *Supracafé* and *Divina Pastora* serve as examples. However, an integral and cohesive ecosystem is indispensable, with support institutions that facilitate its consolidation and growth, and where the leading organisations of the ecosystem are those that promote shared visions to align efforts and find mutually supportive roles.

It is necessary for businesses, academia, and other actors in society to dedicate time and resources to reflect, analyse, and understand the needs of rural women, so that real and joint solutions can be designed with the business criteria that govern inclusive business: commercial viability, social impact, environmental impact, scalability, and cross-cutting innovation.

Inclusive businesses contribute to the achievement of the SDGs, especially SDGs 1, 2, 5, 8 and 10, to the extent that they become platforms for linking vulnerable populations and enable them to achieve levels of wellbeing. Hence, it is crucial to promote social innovation processes, such as the DES pilot programme, in which each actor assumes its own role, overcoming prejudices and betting on joint efforts and complementarity, also giving rise to viable and impactful social enterprises.

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FLORIDA UNIVERSITÀRIA RESPONDING THE CHALLENGES OF THE LOGISTICS INDUSTRY

Rafaela Pizarro-Barceló

Florida Universitària, Catarroja, Spain
rpizarro@florida-uni.es

Mercedes Aznar

Florida Universitària, Catarroja, Spain
maznar@florida-uni.es

Mercedes Herrero-Montagud

Florida Universitària, Catarroja, Spain
mherrero@florida-uni.es

Abstract. The Industry 4.0 phenomenon accompanied by the COVID-19 pandemic have prompted the rapid adoption of measures by the global community, including the world of vocational training and higher education. The challenge facing educational institutions globally is to align learning programmes with the high demand for skills in the industry, whilst narrowing the gap to industrial needs. Since 2021, the logistics industry has increased not only its income compared to other industries, but also its labour demand. This is a great opportunity for educational institutions to prepare students with the requisite skills that the logistics industry is looking for. Due to the lack of professional training and higher education in the area of logistics in the Valencian Community, Florida Universitària, an educational institution that aims to prepare graduates to enter and compete in the industrial market, has designed a complete specialization programme in logistics that integrates vocational education and training, a bachelor's degree and a master's degree.

This study describes this process which cannot be implemented in a short space of time, particularly as changes in the logistics industry occur rapidly and massively. The study programme presented, broken down into the three levels of education mentioned above, aims to prepare graduates who are ready to work and have skills according to the needs and demands of the industry. The method used in this study is quantitative and qualitative; in the former, a survey was carried out with companies in the logistics sector of the Valencian community; and, in the latter, a focus group discussion approach was taken in which the educational institution, the logistics industry and curriculum experts participated.

Keywords: *Logistics Industry, Vocational Education, Higher Studies, Skilled Workers, Education Economics*

1. Introduction

Vocational Training and Higher Education could not stand aside after the emergence of both the Industry 4.0 and the COVID-19 pandemic. It is a challenge that educational institutions must take up by aligning learning curricula with the specific skills demanded by the industry nowadays. A changing world, in continuous and rapid transformation, requires on the one hand, new ways of thinking and doing, and on the other, highly qualified, flexible, emotionally and socially intelligent professional profiles. Professionals who can solve tomorrow's problems today by anticipating changes, proposing new solutions and business models, managing information for decision-

making. By achieving the required professional skills, not only can employers achieve higher levels of competitiveness and growth, but also citizens can apply for good-quality jobs and reach higher standards of living. In this context, the logistics industry has increased not only its income compared to other industries, but also its labour demand. In Spain, employment in the logistics industry grew by more than 22% in 2021, reaching more than one million workers (OTLE, 2022). However, it faces a problem of talent shortage and thus, employers have difficulty finding people with the skills they need to grow and innovate. Logistics employment is characterised by a shortage of talent, of people trained in logistics and transport at practically all professional levels, mainly in management and middle and operational management. Seven out of ten companies consider training in digital, transversal skills and management techniques to be a high priority. The logistics professional of the future will require in-depth knowledge of the tools and techniques associated with logistics as well as full digital skills, very well-developed personal skills (soft skills) and sensitivity towards aspects such as environmental and social sustainability (Manpower Group & Foro de Logística, 2021). Knowledge includes theory and concepts. Competence involves the acquisition and mobilisation of knowledge, skills, attitudes and values to solve new and/or complex situations. The challenge facing educational institutions is to teach new knowledge, competences and skills in a new and different way with student-centred teaching and learning models based on real experiences and enhanced by technology.

We are living in a time of opportunity, especially for the educational world, so that students can go out into the labour market with the knowledge and skills required by today's logistics sector. In fact, as there is no university training in this field in the Valencian Community, Florida Universit aria (an educational institution whose objective is to prepare competitive students for the labour market) has designed a complete curriculum in logistics that goes from vocational training through a Degree and a Master's Degree.

This study describes the process of designing a wide study programme, broken down into the three levels of education mentioned above. It has been the result of a collaborative partnership between social agents, logistics enterprises, and public and private educational institutions. Next, an overview of skills performance and employment needs in the Spanish labour market is carried out, highlighting the low level of skills developed, attained and matched with those that employers require. Finally, a survey with companies in the logistics sector of the Valencian Community is presented together with the collaborative partnership framework that supports the curriculum designed to bridge the gap of the skills mismatches in the logistics industry.

2. Overview Skills Performance and Employment Needs

Skills “are a pathway to employability and prosperity” (European Commission, 2016). With the right skills, not only can employers achieve high levels of competitiveness, but anyone can enter the recruitment process for quality jobs and achieve a better standard of living. In a fast-changing global economy, skills will be the key to enhance our ability to innovate. However, Europe is called to action since skills gaps and mismatches are striking. Many people work in jobs that do not match their talents. At the same time, 40% of European employers have difficulty finding people with the skills they need to grow and innovate. Education providers on the one hand and employers

and learners on the other have different perceptions of how well prepared graduates are for the labour market.

Looking at the European Skills Index (ESI), this index measures countries' distance to the ideal performance, which is scaled to be 100: a score of 100 corresponds to achieving the frontier, whilst a score of 0 corresponds to a lowest-case performance (Cedefop, 2022). The ESI is a composite indicator measuring the performance of EU skills systems through three pillars: development, activation, and matching skills, in which Spain ranks 30th (out of 31 European countries) in the 2022 release remaining at the same position as in 2020, still scoring low in all three pillars. The low scores place Spain in the low-achieving countries group at EU level (see Figure 1).

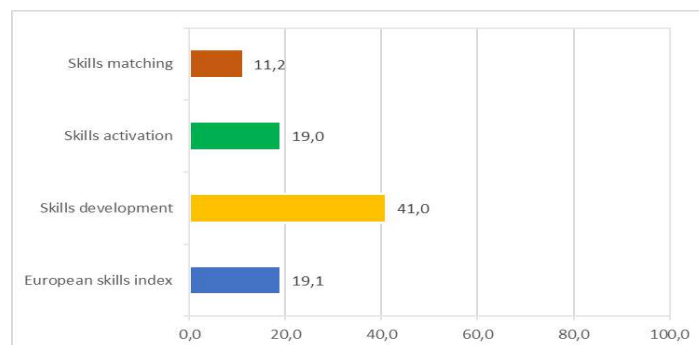


Figure 1 European Skills Index in Spain, 2022 (authors' elaboration)

Skills Development represents the training and education activities of the country and the immediate outputs of that system in terms of the skills developed and attained. Sub-pillars are included to distinguish compulsory education (basic education), and other education and training (lifelong learning) activities (training and other education). For the skills development pillar (see Figure 2), Spain ranks 23rd, with a low performance in upper secondary education (and above) (rank 28th). However, Spain does perform better in the proportion of the population with high digital skills (13th).

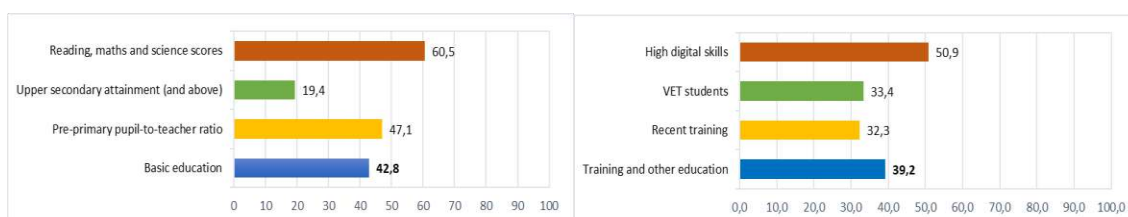


Figure 2 Skills Development in Spain, 2022 (authors' elaboration)

Skills Activation includes indicators of the transition from education to work, together with labour market activity rates for different groups of the population, to identify those which have a greater or lesser representation in the labour market. Sub-pillars are included: transition to work and the labour market participation. For the skills activation pillar (see Figure 3) Spain ranks 29th, with a low performance in the transition to work sub-pillar (30th). Among the indicators of this pillar, Spain's performance ranges from rank 31st in early leavers from training to rank 23rd in activity rate (aged 20-24).

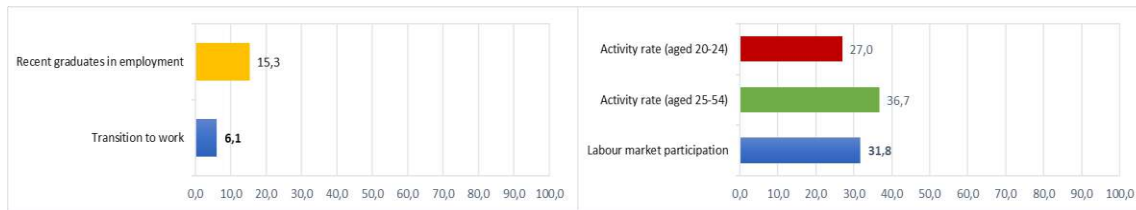


Figure 3 Skills Activation in Spain, 2022 (authors' elaboration)

Skills Matching represents the degree of successful utilisation of skills, the extent to which skills are effectively matched in the labour market. This can be observed in the form of jobs and mismatches which include unemployment, shortages, surpluses, or underutilisation of skills in the labour market. Sub-pillars are included: skills under-utilisation and skills mismatch. For the skills matching pillar (see Figure 4) Spain ranks 30th. In this pillar, Spain ranks towards the bottom in all indicators. The over qualification rate (tertiary education) indicator ranks last (with Greece and Cyprus).



Figure 4 Skills Matching in Spain, 2022 (authors' elaboration)

On the other hand, labour demand trends point out that almost half of total job openings (46%) that are expected to be created in Spain over the period up to 2030 will require high level qualifications (Cedefop, 2020). Just over one third of total job openings will require low medium level qualifications. This means that around one fifth of the job openings will be for workers with low level qualifications. In addition, labour supply trends show that the share of people with high level qualifications in Spain is expected to increase slightly, reaching 38% in 2030 while remaining the largest qualification group. There has been a steady decline in the share of low educated which is expected to continue. Whereas 37% of the labour force was low educated in 2018, their share is expected to drop to 30% by 2030. The segment of medium qualified labour force will increase towards 32% in 2030. In Spain, the rate of labour force with low qualification remains substantially higher than the EU-27 average. Having said that, it is expected that the supply of high skill workers will not be enough to meet the demand for high qualifications. Therefore, some positions requiring high skills might be filled by those with medium level qualifications (see Figure 5).

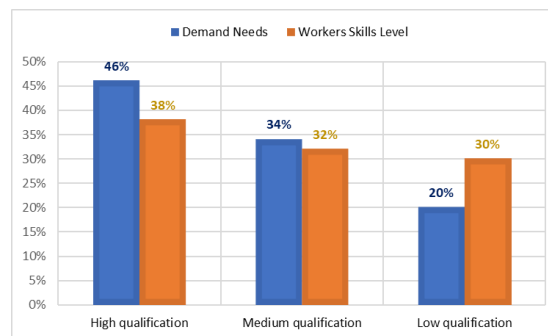


Figure 5 Labour Market Mismatch in Spain (2030 forecast) (authors' elaboration)

Skills gaps and mismatches are striking. Many people work in jobs that do not match their talents. At the same time, many employers have difficulty finding people with the skills they need to grow and innovate. Education providers, on the one hand, and employers and learners, on the other, have different perceptions of how well prepared graduates are for the labour market. Skills mismatches hinder productivity and growth and affect society's resilience to economic shocks. Co-operation with social partners and education and training providers is essential to gap these mismatches.

3. Collaborative learning between education providers and Logistics Industries

Logisticians analyse and coordinate an organization's supply chain – the system that moves a product from supplier to consumer. They manage the entire life cycle of a product, which includes how a product is acquired, allocated, and delivered. Logisticians typically manage a product's life cycle from design to disposal; direct the allocation of materials, supplies, and products; develop business relationships with suppliers and clients; understand clients' needs and how to meet them; review logistical functions and identify areas for improvement; and propose strategies to minimize the cost or time required to transport goods. Logisticians oversee activities that include purchasing, transportation, inventory, and warehousing (Dwiyanti, Wulansari & Okitasari, 2021). Training in logistics must therefore enable the understanding of all the activities that take place from the procurement of raw materials to the delivery of the product to the final consumer.

Logistics, especially in the field of education, is currently not accommodating the needs of industry. Training in this professional field has been linked to that received in Vocational Education and Training (VET), mainly through professional training in Transport and Logistics and International Trade in Spain. However, there is a considerable gap in university education, since there are only two bachelor's degrees in all of Spain. On the other hand, specialization courses for the continuous improvement of workers in the sector cover a wide range of aspects and are highly demanded.

Florida Universitària is involved in this framework, as a vocational training as well as a higher education institution, with extensive experience in teaching ICT, engineering, education, and business. It is deeply concerned on qualification mismatch, that is, the extent to which the level of educational attainment of each graduate/employee matches the level of qualifications required for each occupation in each industry.

Florida Universitària has widely implemented the PBL (Project-Based Learning) methodology in all the programmes range, along with the learning by doing

methodology. We strongly believe that, together with internships developed throughout the curricula, those methodologies improve skills and employability and enhance economic competitiveness and social inclusion.

Assuming the benefits from it and going further, we are committed to intensifying our partnership with the business community by proposing an educational experience in logistics. The perfect formula for up-to-date learning involves constant contact between the student and the company with internships that combine the training centre and the company, with the presence of professionals in the classroom who complement the knowledge and provide a close and real vision. In addition, direct contact and collaboration with the company enables to identify the needs, changes and requirements of the sector, allowing to modify curricula and study plans according to the trends and needs of companies as they adapt to the times.

3.1. Approach to the logistics industry needs

In the Valencian Region there were 7,862 companies in the logistics and transport sector in 2021 (according to SABI database), of which 62% belong to road freight transport, 7% to road passenger transport and 25 % to storage and transportation-related activities, being mostly SMEs (96%). Geographically, 58% are in Valencia, 30% in Alicante and the rest in Castellón, which are the three provinces in the region.

A random sampling of 40 Valencian companies has been carried out to find out the needs of the sector, the most valued skills, and the most demanded jobs. Research has identified logistician skills and knowledge that students would need to prepare them for work in the logistics industry. Using a Likert scale, from 1 (least valued) to 5 (highest valued), both the skills development (see Figure 6) and the academic knowledge (see Figure 7) seem to be relevant to the labour demand.

There is an increasing focus on the softer skills, such as teamwork, problem solving, ethical responsibility, organization, planning and time management, and innovation and entrepreneurship, mainly.



Figure 6 Logistician skills required (authors' elaboration)

Regarding the knowledge required, those related to transport management, languages, cost analysis, international logistics, and ICT stand out.



Figure 7 Logician knowledge required

When asked about job vacancies forecasts in both their own organizations and in the logistic industry, fleet management ranks the list followed by research and development project, information technology and communication.

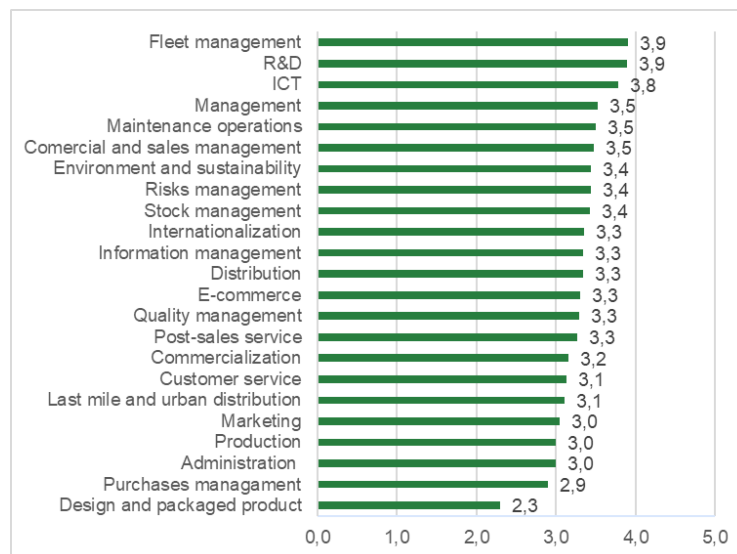


Figure 8 Job vacancies forecast (authors' elaboration)

Additionally, qualitative research was carried out with a focus group discussion approach that involved Florida Universitària, the logistics industry, and curriculum experts. In these group sessions, the logistics industry confirmed the shortage of qualified workers, who must have knowledge of ICT, international operations, and management of research and development projects, mainly. In addition, they highly valued teamwork, resilience, and analytical capacity in solving problems and conflicts. Logistics professionals also agreed to intensify collaborative partnerships between educational centres and the business sector to get well-qualified students who should be willing to get involved in the challenges of the sector.

3.2. Collaborative partnership

Collaboration between educational institutions and industries is one of the keys to developing a training curriculum that matches industrial demand. Collaboration is also a good way to collect more information on what industry needs. Industries should cooperate with the educational centre to support teachers and students, and they could also get more involved in the curriculum design and learning process.

Florida Universit aria is committed to improving the employability of not only our students but professional workers as well. To bridge the skills gap and mismatches in the labour market in the logistics sector, an effective collaboration is proposed that involves the main stakeholders (see Figure 9).

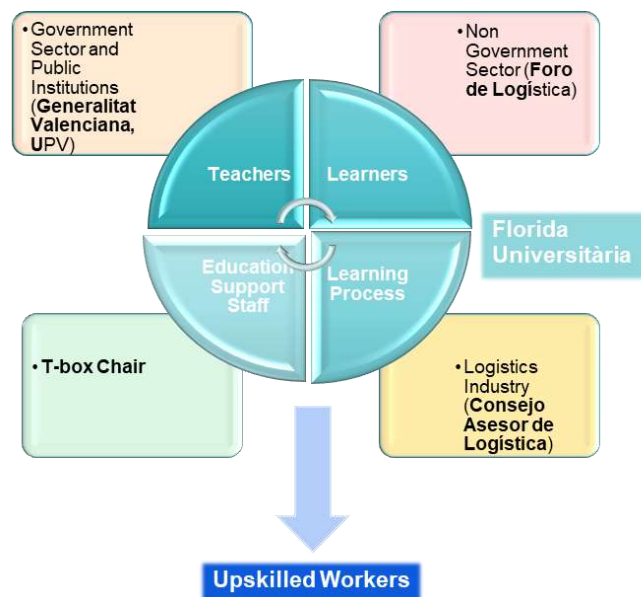


Figure 9 Collaborative Partnership System

On the one hand, the main key is to set a very close communication with companies in the industry, which is why the *Advisory Council for Logistics and Transport* (Consejo Asesor de Logística y Transporte) is created, made up of more than 40 companies in the sector, mainly representing storage and transportation-related activities (63%), transport (28%), and business and public associations (9%) (see Figure 10).

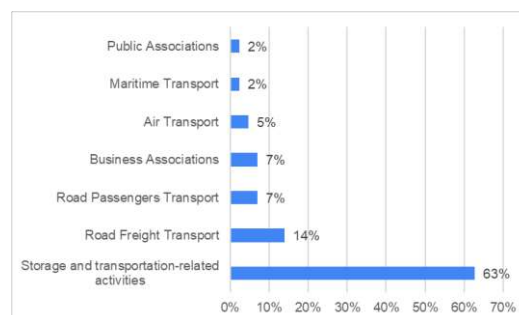


Figure 10 Advisory Council for Logistics and Transport Composition (authors' elaboration)

It is a consultative body that participates in the curricular design of training, intervenes in educational learning activities, both in the classroom and in the company, provides internship programmes, and informs teachers about the new challenges that affect the sector. And on the other, collaboration with experts, such as the Logistics Forum (Foro de Logística), is essential to promote fluid and continuous communication with companies; in addition, they actively participate in the design of the curriculum in the bachelor's degree and master and oversee the organization of events together with the industry and other experts. Furthermore, a key element of this collaboration is the *T-box Chair of Advanced Logistics for the Last Mile* that is directly involved in VET through applied research projects that allow students to develop their skills, solving a real challenge, and getting closer to the business world. In addition, this chair aims to promote the creation, in the medium term, of a *Research Centre on Urban Logistics and the Last Mile*, with the following objectives: research, innovation and knowledge development in all areas of Urban Logistics, with special attention to Last Mile Management, training, information and talent management for sustainable, efficient and resilient logistics, and development and analysis of business models and promotion of entrepreneurship. It will be a pioneering experience in the field of professional training that will establish a new teaching approach that gives real answers to real problems, that is, that prepares the future worker to successfully face the needs that arise. And, finally, the public authority must be taken into account for the fulfilment of the curricular requirements.

Ultimately, we are talking about creating practical opportunities within education systems. This requires strengthening and consolidating the collaboration of business and educational institutions both in terms of volume and diversity of forms of collaboration, thus recognising the role of business as an educational, research and employment agent, and ensuring their involvement in the student's learning experience.

3.3. Curriculum design

As a result of this incipient cooperation with the logistics industry, Florida Universitària has presented a training scheme in the field of logistics that ranges from professional training to the most specialised programmes. The first result of this multilevel collaboration has been the start of the VET in *Transport and Logistics* in September 2021 and, more recently, the launch of the degree in *Transport and Logistics Management* (together with the Polytechnic University of Valencia) that will begin in September 2022 (see Table 1). Considering the needs of the sector as well as the skills mostly in demand, these educational projects aim to improve the employability of students, increase talent in the sector and reduce skill mismatches between supply and demand.

Table 1 Curriculum Programme Design

Level	Training	Learning Methodology	Skills and Knowledge (highest ranked)	Outcomes
VET	<i>Transport and Logistics</i> (Sep 2021)	Learning by doing Project-based learning Problem solving Applied research	Teamwork Communication Problem solving Self learning	Medium Skilled Workers
	<i>International Trade</i> (forthcoming)	Internship Case study Digital tools	Transport operations Purchases and warehouse operations Understanding technologies	
Bachelor Degree	<i>Transport and Logistics Management</i> (Sep 2022)	Learning by doing Project-based learning Problem solving Applied research Research project Internship Workshops Logistic software	Teamwork Problem solving Ethical responsibility Organization, planning, and time management Innovation and entrepreneurship Leadership Transport management Languages Cost analysis International logistics ICT	High Skilled Workers
Master	<i>Logistics and Supply Chain</i> (Oct 2022)	Learning by doing Learning by expertise Learning by experience	Supply chain management Lean logistics Green logistics International logistics	Up-to-date Skilled Workers

We firmly believe that this system of collaboration between these actors (industry, social agents, public institutions, and educational institution) lays the foundations for future graduates to have the skills and knowledge required in their professional work and allows them to continuously adapt to the challenges of the market and industry. Hopefully, we could help bridge the gap of the skills mismatches in the logistics industry.

4. Conclusions

The lack of talent and professional skills and qualifications in the logistics sector is shocking, especially considering that it is a booming sector and even more so since the emergence of COVID-19 in the world. It is easy to find a good number of cases where jobs are held by people who do not have the necessary talent for them. On the other hand, it is evident that the business world has real problems in finding professionals who can help their companies to grow, innovate and be competitive. It is therefore imperative to establish a link between academia and business that feeds back and benefits each other.

In order to fill these gaps, Florida Universitària has a strong commitment to creating strong links with the logistics sector, which has led to the development of an educational experience in logistics presented here. The process of designing a broad programme of studies covering vocational training, undergraduate and postgraduate studies has been described that will allow to bridge the gap in skills and qualifications. But most importantly, it has been the result of close collaboration between social partners, companies in the logistics sector, and public and private educational institutions.

On the one hand, students will be able to enter the labour market with the qualifications required by the sector at a high competitive level. And on the other hand, the industrial logistics sector will be able to find those assets that will allow them to grow and develop in a world as complex as the one we are currently living in.

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PROFESSIONAL PAPERS

ARDUINO RFID LOCK WITH GSM MODULE

Siniša Zorica

University of Split, University Department of Professional Studies, Split, Croatia
szorica@oss.unist.hr

Sandra Antunović Terzić

University of Split, University Department of Professional Studies, Split, Croatia
santunov@oss.unist.hr

Marinko Lipovac

University of Split, University Department of Professional Studies, Split, Croatia
lipovac@oss.unist.hr

Joško Smolčić

Craft Technical School Split, Croatia
josko1911@gmail.com

Ivan Kuić

University of Split, University Department of Professional Studies, Split, Croatia
ik47640@oss.unist.hr

Abstract. The paper presents the application of RFID technology for opening an electronic lock. An electronic lock can be installed anywhere and a small wooden box has been made for this purpose. The box simulate the safe for valuables and documents. The system is based on the Arduino platform. Arduino is an open source electronic prototype platform designed to create a variety of electronic projects. In addition to RFID technology, the use of GSM technology can expand the possibilities of the system. It allows opening electronic lock via GSM communication. The possibility of application is, for example, in the field of tourism where it is possible to open the door to guests from a remote location, or allow them to open the door without a key. It can be used to control air conditioning system etc. GSM communication can be used to send various information, since it provides two-way communication. This paper gives an example of use GSM communication to send alarm in case of forced opening of the box, and to send temperature and humidity data from inside the box to the user. There are a number of sensors that can be used with the Arduino platform, so there are unlimited application possibilities

Key words: *Arduino remote lock, RFID technology, GSM communication*

1. Introduction

One of the important economic branches in Croatia is tourism. Accommodation capacities mainly consist of hotels, camps and more and more private facilities. Private facilities are mostly houses and flats where citizens live outside the tourist season, and during the season, they rent them out as apartments to tourists. In tourism, one of the important things is the safety of tourists, both themselves and their property. As for the protection of their property, it is very well resolved at the hotels. Hotel guests receive a card at check-in to open the room door, and valuables can be left in the safe at the hotel reception. The use of cards prevents unauthorized entry into the room and it is possible to monitor who and when opened the door of the room. Unfortunately, private

renters use mechanical locks to enter the apartment. These locks can be easily hacked by unwanted people thereby allowing unauthorized personnel into secured premises. In addition, the owner of the apartment does not change the lock when new guests arrive, so there is a possibility that the previous guest made a copy of the key. Apartments usually have a small safety deposit box. The safe is usually unlocked with a digital keyboard. For the guest of the apartment, the programming of the safe is complicated and they often forget the code they set. The solution to these problems is to use automatic access control to open the door and to use the deposit safe box [1],[2],[3].

There are several automatic access control technologies including barcode, magnetic stripe and Radio Frequency Identification (RFID). Radio-Frequency Identification (RFID) is an emerging technology and one of the most rapidly growing segments of today's access control. The use of GSM modules ensures additional security of the system as well as expanding the possibilities of the same in the form of using various sensors such as temperature sensor, humidity sensor, etc.

The paper presents the development and production of access control for safety deposit box. Access control is based on Arduino microcontroller and uses RFID and GSM technology for access control and for additional security in case of unauthorized opening of the safe. Additionally, the system sends information about the temperature and humidity inside the safe to the user's mobile phone. Entrance doors with electronic lock can be unlocked using the same system.

2. Methodology

The basic components of the system are the Arduino Uno development board, RFID reader, GSM shield, magnetic lock, two-colour LED and piezo buzzer. The box must always be locked, regardless of whether it is connected to the power supply. While the box is locked, the LED lights up red. It is unlocked with an RFID tag or a call from a mobile phone. Within the program, there is a list of authorized RFID UID numbers and authorized mobile phone numbers. If the box is unlocked, the LED lights up green and the user has 5 seconds to open it. The box locks automatically if not opened within 5 seconds. In case the box is successfully opened, the LED lights up green until the box lid is closed. After closing the lid, the LED lights up red and the box locks. If there is attempt to open with an incorrect RFID tag, the LED flashes yellow. In the event of a forced opening of the box, the Arduino sends a message to the user of the box on the mobile phone, after which an alarm is triggered. The alarm is deactivated by reading the RFID tag or detecting an incoming call. The user can receive on request information about the temperature and humidity in the box via SMS.

3. Hardware Overview

3.1. RFID Technology

RFID stands for Radio Frequency Identification and it is a non-contact technology that is broadly used in many industries for tasks such as personnel tracking, access control, supply chain management, books tracking in libraries, tollgate systems, etc.[4]. Generally, the system consists of two main components, a RFID tag that has unique UID number and a reader, installed at the protected object.

RFID reader consists of a radio frequency module, a control unit and an antenna coil that generates high frequency electromagnetic field as shown in Figure 1. On the other hand, the tag used in this work is a passive component, which consists of just an antenna and an electronic microchip. When it gets near the electromagnetic field of the transceiver installed at the secured entrance (5 to 15cm), due to induction, a power is generated in the tags' antenna coil and this voltage serves as power for the microchip of our system tag. When the tag is powered, the transceiver read UID form tag.

The RFID reader MFRC-522 shown in Figure 2 is used for designed system. It operates at a frequency of 13.56 MHz and its supply voltage is 3.3V. The reading distance of the sensor is up to 5cm, the current consumption is 10mA at standby and 26mA in the active state.

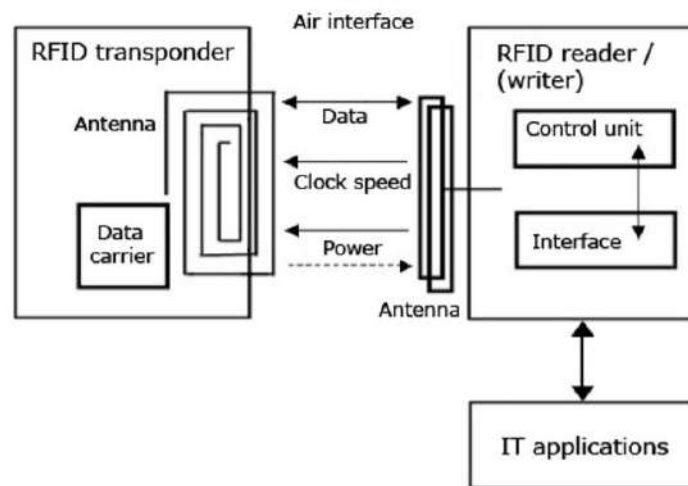


Figure 1 RFID Working Principles



Figure 2 MFRC-522

The reader connects to Arduino Uno pins as shown in Table 1.

Table 1 Connection of MFRC 522 to Arduino Uno

MFRC-522	Arduino Uno pin
RST	9
SDA(SS)	10
MOSI	11

MISO	12
SCK	13
Vcc	+3,3 V
GND	GND

3.2. GSM shield

For designed system, GSM module "Arduino GSM shield 2" with integrated antenna, shown in Figure 3 is used. Arduino GSM Shield 2 allows Arduino board to connect to the Internet, receive calls or make, send or receive SMS messages [5]. Shield uses an M10 radio modem manufactured by Quectel. It is possible to communicate with the board using AT commands. The GSM library has a large number of methods of communication with the shield. Shield uses digital pins 2 and 3 for software serial communication with the M10 radio modem. Pin 2 is connected to the TX pin, and pin 3 to the RX pin of the modem. The PWRKEY modem pin is connected to the Arduino Uno pin 7. The M10 is a Quad-band GSM / GPRS modem operating at GSM850MHz, GSM900MHz, DCS1800MHz and PCS1900MHz. Supports TCP / UDP and HTTP protocols over GPRS connection. The maximum GPRS data transfer rate and transfer rate is 85.6kbps.

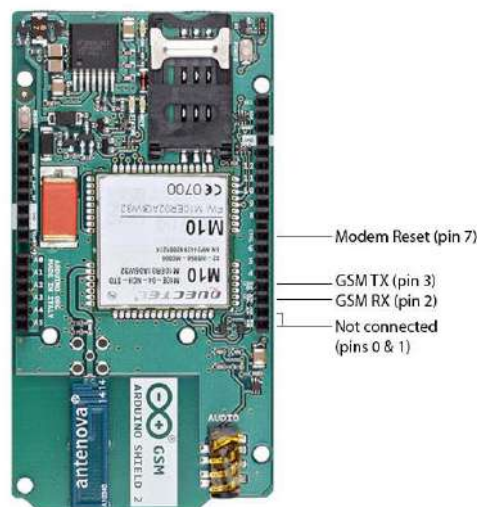


Figure 3 GSM shield

3.3. Electromagnetic lock

For the electromagnetic lock, a lock HD0620, shown in Figure 4, is selected, with the following characteristics: supply voltage 12V, current 0.43A, and power consumption 5W. The manufacturer states that the lock must not be turned on for more than 5 seconds, otherwise it will be damaged.



Figure 4 Electromagnetic lock HD0620

3.4. Relay board

The relay board shown in Figure 5, based on the SRD-05VDC-SLC relay, is used. The relay is activated with a voltage of 5V, and the output can be connected to a current consumer up to 10A, and a voltage of 125VAC or 28VDC.



Figure 5 Relay board

Figure 6 shows the relay board schematic diagram. The board has an optocoupler for protection, not used in this project.

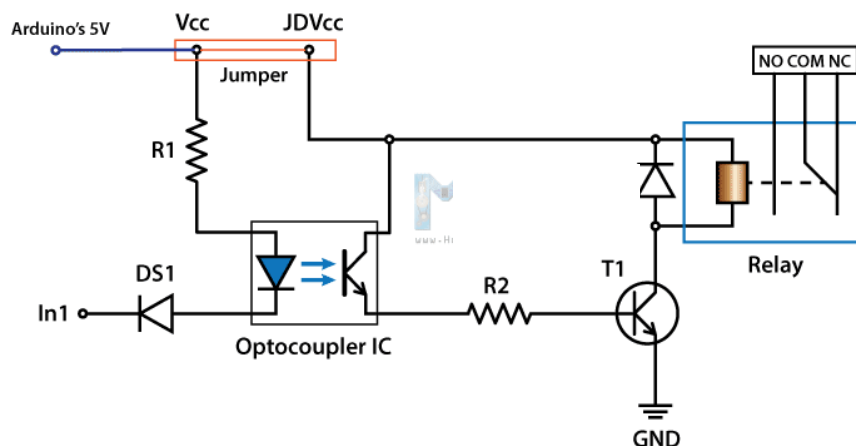


Figure 6 Relay board schematic diagram

3.5. DHT22

DHT22 is a capacitive sensor for measuring relative humidity and air temperature, shown in Figure 7. The sensor has excellent quality; it is very precise, but also a bit more expensive and slower (two seconds). In addition to the measuring device, the module also consists of an 8-bit microcontroller and OTP memory used for the calibration. Small size, low power consumption and long distance data transmission (> 20m) make it applicable to many devices.



Figure 7 DHT22 sensor

Technical specification of DHT22 are given in Table 2.

Table 2 Technical Specification

Power supply	3.3-6VDC
Output signal	digital signal via single-bus
Sensing element	Polymer capacitor
Operating range	humidity 0-100%RH; temperature -40~80Celsius
Accuracy	humidity $\pm 2\%$ RH(Max $\pm 5\%$ RH); temperature $< \pm 0.5$ Celsius
Resolution or sensitivity	humidity 0.1%RH; temperature 0.1Celsius
Repeatability	humidity $\pm 1\%$ RH; temperature ± 0.2 Celsius
Humidity hysteresis	$\pm 0.3\%$ RH
Long-term Stability	$\pm 0.5\%$ RH/year
Sensing period	Average: 2s
Interchangeability	fully interchangeable
Dimensions	small size 14*18*5.5mm; big size 22*28*5mm

The accuracy of the measurement is not linear and depends on the measured quantities, as shown in Figure 8.

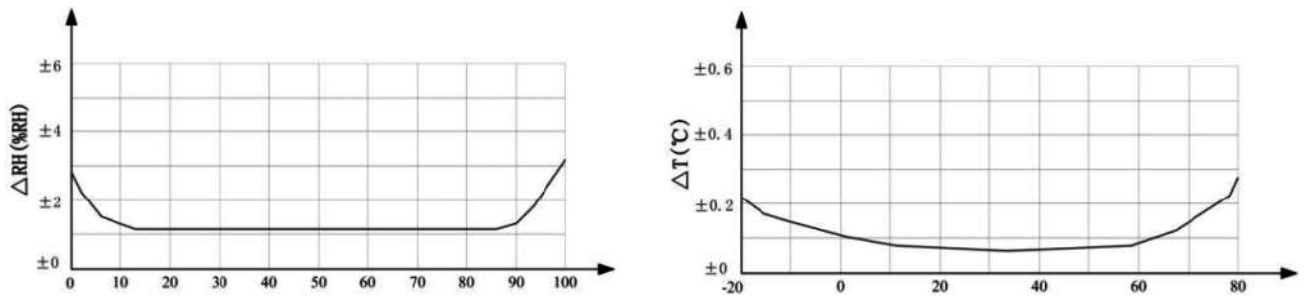


Figure 8 Measurement accuracy

3.6. Two-colour LED –

The L-59 EGW two-tone LED is used. The diode is made of a combination of gallium arsenide phosphide and gallium phosphide. The diode has a common cathode as shown in Figure 9.

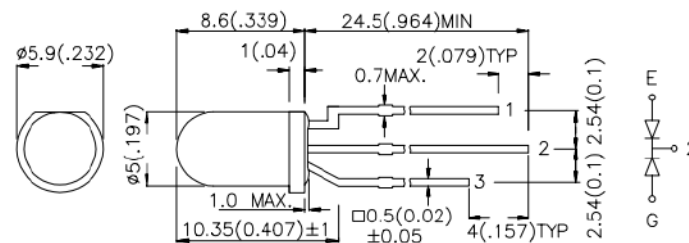


Figure 9 L-59 EGW two-tone LED

The LED lights up red or green. If the voltage is applied to both diodes, the LED lights up yellow. Therefore, the LED can be used as a tricolour LED.

4. Circuit design

The main parts of the circuit are Arduino Uno, RFID shield and GSM shield. The system controls the electromagnetic lock using RFID and GSM communication. An HD0620 lock with the following characteristics is used for the electromagnetic lock: supply voltage 12V, current 0.43A and power consumption 5W. The selection of the 12V supply voltage lock determine the power supply characteristics of the system. Power supply was planned to be built using voltage regulator 7812 according to the scheme in Figure 10.

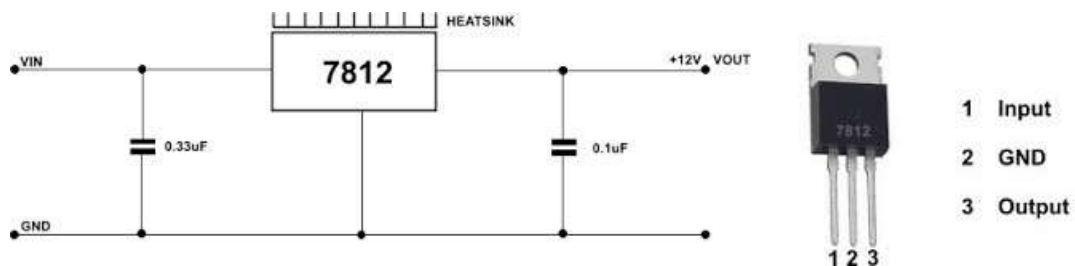


Figure 10 Power supply based on IC 7812

However, the analysis of production costs showed that it is cheaper and easier to buy a ready-made DC-DC converter (buck) based on voltage regulator LM2596, shown in Figure 11. The circuit can regulate the output voltage in the range of 1.25V-37V. The input voltage must be 1V higher than the output. The circuit can provide a constant output current of 2A, with peak values up to 3A, which is enough to power the circuit. The price of the voltage regulator on ebay.com is approximately 2USD.



Figure 11 Power supply based on LM2596

The control of the electromagnetic lock was designed to be performed using a transistor as a switch, as shown in Figure 12.

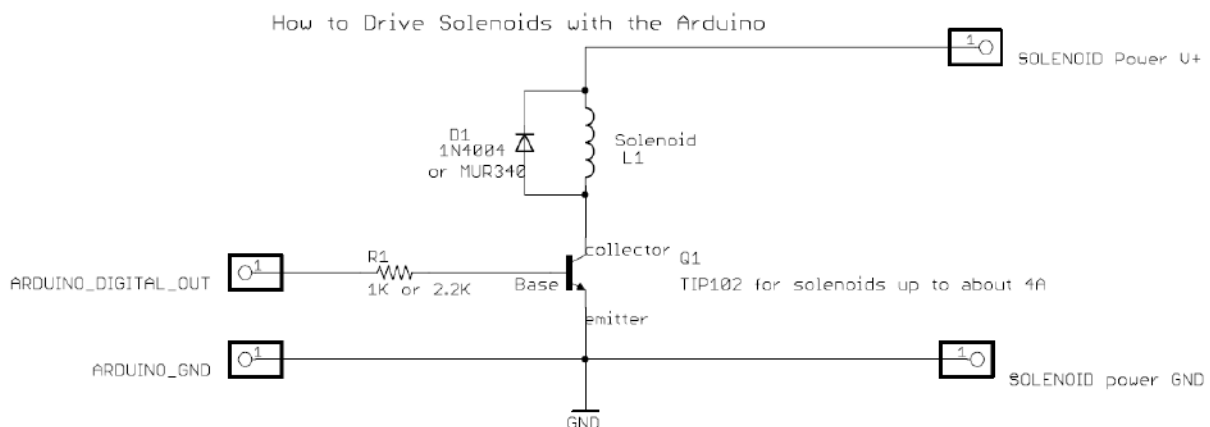


Figure 12 Transistor switch for electromagnetic lock

However, since there is a small voltage drop between the collector and emitter on the transistor, the question was whether the electromagnetic switch will work if the voltage on it is less than 12V. For this reason, a relay is used instead of a transistor switch, depicted in Figure 5. The relay board is also purchased through ebay.com, and its price is around \$1.42. After selecting the basic components, a prototype is built. Arduino UNO, RFID shield and LED that simulated an electromagnetic lock are connected. After the circuit was connected and a program written, the LED is replaced with a relay and an electromagnetic lock. After that, a problem occurred, the circuit resets after the lock was disengaged. The reason for this is that when the electromagnetic lock is activated, the coil of the electromagnet stores energy in the form of a magnetic field. After the power supply of the electromagnet switch off, the magnetic field decomposes and the coil generates a voltage proportional to the rate of decomposition of the field, according to Faraday's law. Since the field degrades rapidly, a short high voltage pulse is induced in the coil. This impulse can damage the circuit. In this case, the circuit

reseted. The problem is solved by placing diode 1N4007 parallel to the electromagnet. Since the induced voltage of opposite polarity, the diode conducts and absorbs this pulse. Although this problem is well known, a protective diode was not added initially to the electromagnetic lock because it was assumed that the diode at the relay board output, shown in Figure 6, would serve this purpose.

After the successful prototype, the system is built according to Figure 13.

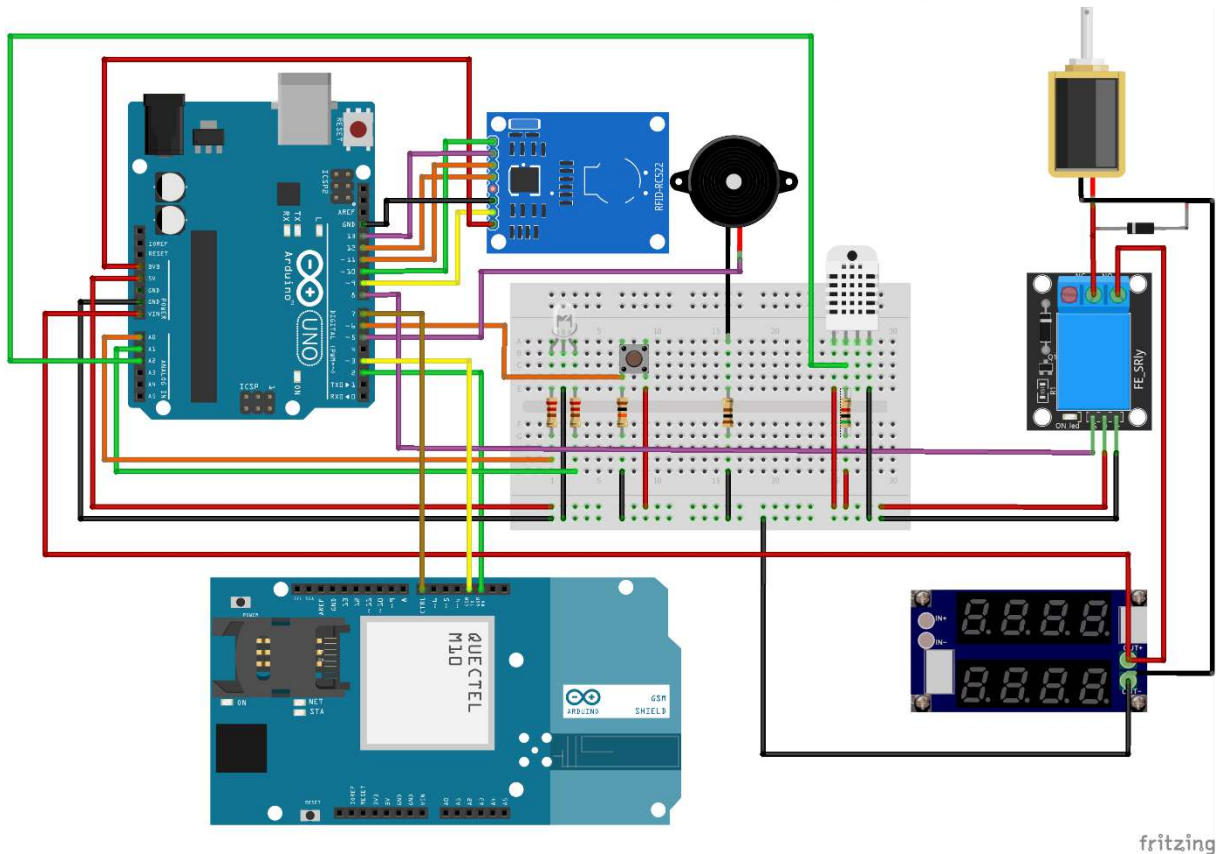


Figure 13 Schematic representation of the system

GSM module, piezo buzzer, two-tone LED for signalling the status of the box, DHT22 sensor for measuring temperature and humidity inside the box, micro switch with lever to detect the condition of the box lid are added. Due to the large number of components, the "Proto Screw" shield is used, shown in Figure 14. It expands the number of Arduino pins by having more ground and power pins. The wires are fastened with screws, which ensures a better and more durable connection.



Figure 14 „Proto Screw“ shield

Figure 15 depicts full working system.



Figure 15 Fully operating deposit box

5. Software overview

At system start up, the program starts and all components are initialized. It is necessary to enter UID of the tags that can open the box, and the number of the mobile device to which the warning about the unauthorized opening of the box will be sent, as well as the data on temperature and humidity inside the box.

```
#include <MFRC522.h>
#include <SPI.h>
#include <GSM.h>
#include <DHT.h>
#define SS_PIN 10
#define RST_PIN 9
#define PINNUMBER "" //SIM card pin
```

```
#define DHTPIN A2 //DHT sensor pin
#define DHTTYPE DHT22 // DHT 11 //DHT Sensor type
DHT dht(DHTPIN, DHTTYPE); // Initialize DHT sensor for normal 16mhz
Arduino
MFRC522 mfrc522(SS_PIN, RST_PIN); // Instance of the class
// GSM shield initialization
GSM gsmAccess;
GSMVoiceCall vcs;
GSM_SMS sms;
String tagUID1[ ]= {"81:EE:BD:1B", "40:1B:2D:83"}; //My RFID tag UID
String tag=""; //For store UID of detected tag
int goodtag=0;
int sklopka = 6; // Micro switch pin
int val=0; //Micro switch state (0 - lid closed; 1 - lid opened)
int buzzer=5; //Piezo buzzer pin
int brava=8; //Electromagnetic lock pin
String remoteNumber = "097694250"; // Mobile phone for call
char remoteNum1[20] = "097694250"; // Mobile phone for SMS
char charbuffer[20];
char txtMsg[200];
char c; //Variable to store SMS message
```

In the "Setup" part of the program, the command `pinMode(brava, INPUT_PULLUP)` is very important. It ensures that the electromagnetic lock is locked when the box is switched on. Otherwise, there is a possibility that the electromagnetic lock will be unlocked for a moment when the power is turned on, which is enough time for an unauthorized person to access the contents of the box. Also in the "Setup" part of the program there is a loop waiting for the GSM shield to connect to the network. This is also a disadvantage of the system, because in case of inability to connect to the network (no signal, network failure or expired card) the box cannot be opened.

```
void setup() {
    pinMode(brava, INPUT_PULLUP); //Prevent relay trigger on bootup
    pinMode(brava, OUTPUT);
    pinMode(sklopka, INPUT);
    pinMode(buzzer, OUTPUT);
    Serial.begin(9600);
    SPI.begin(); // Init SPI bus
    dht.begin(); // Init DHT sensor
    mfrc522.PCD_Init(); // Init MFRC522
    boolean notConnected = true; // connection state GSM
    // Start GSM shield - waits until AIM card is registered on the
    network
    // If your SIM has PIN, pass it as a parameter of begin() in quotes
    while (notConnected) {
```

```

    if (gsmAccess.begin(PINNUMBER) == GSM_READY) {
        notConnected = false;
    } else {
        delay(500);
    }
}

// This makes sure the modem correctly reports incoming events
vcs.hangCall();
}

```

The program is divided into three parts. In general, the circuit is in standby mode. It reads values from the DHT22 sensor, checks the status of the switch to detect if the box is open, checks if an SMS message or call has arrived.

If a valid RFID tag UID is detected or a GSM shield call is received, the electromagnetic lock is activated for 5 seconds and the green LED lights up. If it does not open within this time, the circuit returns to standby mode and the colour of the LED changes to red. If the box is opened, the system waits until the box is closed. If a tag that does not have a valid UID is detected, the LED will flash three times yellow.

If the box is opened without proper authorization, a GSM call is made to the box owner first. After the call is completed, the piezo buzzer sounds as an audible alarm. The buzzer stops working after reading the correct RFID tag or receiving a call.

Upon receiving an SMS message, the GSM shield sends temperature and humidity information to the default mobile number. The program states that the correct message must contain the letter "A".

```

    if (sms.available()){ //If SMS message is received
        c=sms.read(); //Store SMS message to variable c
        if (c=='A') {
            String txtMsg=("Temperature: " + String(t) + "*C " + '\n'+
"Humidity: " + String(h) + "%");
            sms.beginSMS(remoteNum1); //Start sending SMS
            sms.print(txtMsg); //SMS message
            sms.endSMS();
            sms.flush(); //Delete received SMS
            c="";
        }
        sms.flush(); // Delete received SMS
    }
}

```

System security is based on the fact that only the owner of the box knows the SIM card number. However, unlike calls, the operator often sends messages (notifications, SIM card expiration, etc.) so that the GSM module does not send messages after receiving any message, it is set that the box must receive a message containing only the letter "A".

In addition, it is very important to delete received messages with the `sms.flush ()` command. Otherwise, the unit automatically sends SMS messages when the device is turned off and on again. An `int getID ()` function has also been created whose task is to read the serial number of the RFID card and write it in the form "00: 00: 00: 00".

```
int getID() {
    // Getting ready for Reading PICCs
    if ( ! mfrc522.PICC_IsNewCardPresent() ) { //If a new PICC placed to
RFID reader continue
        return;
    }
    if ( ! mfrc522.PICC_ReadCardSerial() ) { //Since a PICC placed get
Serial and continue
        return;
    }
    // There are Mifare PICCs which have 4 byte or 7 byte UID care if you
use 7 byte PICC
    // String tag = "";
    for (byte j = 0; j <= 3; j++)
    {
        tag.concat(String(mfrc522.uid.uidByte[j] < 0x10 ? " 0" : ":"));
        tag.concat(String(mfrc522.uid.uidByte[j], HEX));
    }
    tag.toUpperCase();
    mfrc522.PICC_HaltA(); // Stop reading
    mfrc522.PCD_StopCrypto1();
    return;
}
```

6. Conclusion

The paper presents the application of RFID and GSM technology for access control. The system is tested and works without errors. The disadvantage of the device is the inability to open the box if the SIM card is not connected to the GSM network. Care should also be taken to ensure that the SIM card does not expire in case of prepaid SIM card. In addition, it is necessary to design a battery power supply that will be located inside the box and provide power to the system in the event of an external power outage.

The developed system is a functional prototype. In the case of commercialization of the device, it would be necessary to minimize the hardware, and be sure to work on the protection of the system. Current protection is based on the secrecy of the SIM card number used. It should be possible for the user to add mobile numbers and UID numbers that can access the lock, and use the crypto algorithm for SMS communication.

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USING AUGMENTED REALITY FOR DATA VISUALIZATION OF IoT SENSORS

Sandra Antunović Terzić

University Department of Professional Studies, Split Croatia
santunov@oss.unist.hr

Siniša Zorica

University Department of Professional Studies, Split Croatia
szorica@oss.unist.hr

Joško Smolčić

Craft Technical School Split, Croatia
josko1911@gmail.com

Tonko Kovačević

University Department of Professional Studies, Split Croatia
tkovacev@oss.unist.hr

Abstract. Abstract. The Arduino board is the popular open-source hardware that can be integrated into a variety of electronic projects. The Internet of Things (IoT) refers to the network of physical objects—"things"—equipped with sensors which collect data, for the purpose of connecting and exchanging data with other devices over the internet. Arduino can be connected with various Internet of Things (IoT) platforms that can be used for the storage of real-time streaming sensor data. Augmented Reality is a technology that combines virtual reality with our physical world. Viewing the real world through the screen of a device, usually a mobile phone, the computer-generated digital content is layered over the physical world in a way that makes it appear to be part of the real environment. The aim was to represent collected data into the physical world using Augmented Reality. In this project, Augmented Reality is used to monitor the data captured by sensors connected to IoT board. In our case, the environmental data: indoor air temperature and humidity are captured by sensors connected to Arduino microcontrollers. The board is connected to the cloud server and sends sensor data to an Augmented Reality App. The app projects the sensor data as the camera of the mobile phone focus on a target image. The project shows that data can be visualized using Augmented Reality.

Key words: ESP32, Internet of Things, Augmented reality, IoT platform, Blynk

1. Introduction

The Internet of Things (IoT) refers to all devices that can connect to the Internet to collect, share and transfer data over a wireless network.

IoT has grown to be a marketing trend and general news piece. Beyond exaggeration, IoT appeared as a powerful technique with appliances in numerous domains. IoT has origins in multiple former methods: sensor networks, embedded systems and pervasive informatics [1].

Augmented reality combines information and virtual elements with real world imagery acquired through a camera. AR is becoming increasingly popular in common application for general public entertainment (e.g., gaming, video, and photo filters in

social media mobile applications). In specific fields, there are other works, focused on marker detection, information security, platforms for interaction with devices, and IoT [2].

The problem with IoT is that the number of IoT connected devices is growing exponentially. As a result, we have a large amount of IoT generated data that we are not able to process or use. This is where AR comes in. IoT devices capture data from the physical world so that it can be analysed, and AR devices take that digital data and render it back on the physical world for people to view and interact with them. Therefore, using the combination of IoT and AR is a recent trend. IoT and AR applications can help users in three ways:

- Visualizing data and interacting with the environment - IoT-AR solutions help visualize, analyse, and understand data, which in turn allows users to better navigate their environment. Users can more intuitively understand data by looking at it in three dimensions. Providing relevant data or knowledge to the user in solving problems is the most effective way to help them in their work.
- Diagnosing Problems – IoT-AR applications combine different types of data into one view, helping users to better analyse objects and spaces, as well as diagnose problems in physical objects and their surroundings.
- Taking action – IoT-AR solutions help users to make better decisions by combining a high volume and large variety of context-specific data into a single view.

The development and application of IoT-AR solutions is currently the most widespread in the industry. Several industries are pioneering the use of IoT and AR technologies at the same time. Heavy industries are showing the way, followed by technology, engineering, aerospace, telecommunications, and media. In functions such as equipment maintenance, IoT and AR applications already represent the state of the art.

Today, numerous AR devices are used. The smartphone is the most popular (51%), followed by Microsoft HoloLens (39%), Google Glass (18%), custom devices (17%), head-mounted displays (16%), RealWear wearables (11%), and the Magic Leap display (9%) [3].

The idea of this project is built 3D AR application that will display temperature and humidity in real time on a smartphone.

2. Proposed system

2.1. Hardware

2.1.1. ESP32

The development board equips the ESP-WROOM-32 module containing Tensilica Xtensa® Dual-Core 32-bit LX6 microprocessor. This processor has two CPU cores (can be individually controlled), operates at 80 to 240 MHz adjustable clock frequency and performs at up to 600 DMIPS (Dhrystone Million Instructions Per Second).

There is also 448 KB of ROM, 520 KB of SRAM and 4MB of Flash memory (for program and data storage). The ESP32 Integrates 802.11b/g/n HT40 Wi-Fi transceiver, so it can not only connect to a Wi-Fi network and interact with the Internet, but it can also

set up a network of its own, allowing other devices to connect directly to it. The ESP32 supports WiFi Direct as well, which is a good option for peer-to-peer connection without the need of an access point. Power to the ESP32 development board is supplied via the on-board MicroB USB connector.

Although the ESP32 has total 48 GPIO pins, only 25 of them are broken out to the pin headers on both sides of the development board, shown in Figure 1. These pins can be assigned to all sorts of peripheral duties, including: 15 ADC channels, 2 UART interfaces, 25 PWM outputs, 2 DAC channels, 3 SPI & 1 I2C interfaces and 9 Touch Pads. A single GPIO pin can act as an ADC input/DAC output/Touch pad thanks to the ESP32's pin multiplexing feature.

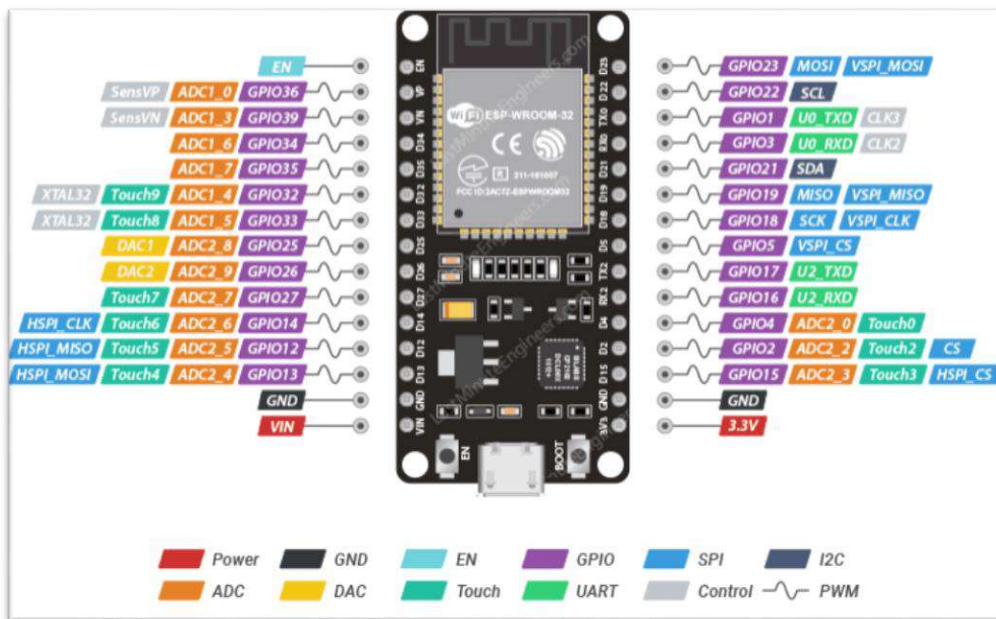


Figure 1 ESP32 development board

The ESP32 development board features two buttons. One marked as EN located on the top left corner is the Reset button. The other Boot button on the bottom left corner is the download button used while downloading the new sketch/programs.

The board includes CP2102 USB-to-UART Bridge Controller from Silicon Labs, which converts USB signal to serial and allows your computer to program and communicate with the ESP32 chip.

There are two power pins, VIN pin & 3.3V pin. The VIN pin can be used to directly supply the ESP32 and its peripherals, using regulated 5V voltage source. The 3.3V pin is the output of an on-board voltage regulator. This pin can be used to supply power to external components.

2.1.2. DHT11 sensor

DHT11 sensor, shown in Figure 2, consists of a capacitive humidity sensing element and a thermistor for sensing temperature. The humidity sensing capacitor has two electrodes with a moisture holding substrate as a dielectric between them. Change in the capacitance value occurs with the change in humidity levels. The IC measure, process this changed resistance values and change them into digital form.

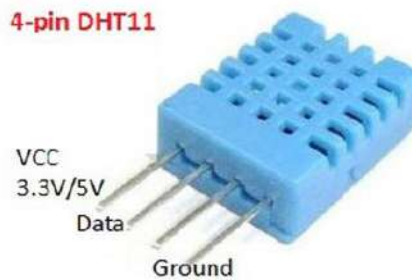


Figure 2 DHT11 sensor

The temperature range of DHT11 is from 0 to 50 degree Celsius with a 2-degree accuracy. Humidity range of this sensor is from 20 to 80% with 5% accuracy. The sampling rate of this sensor is 1Hz i.e. it gives one reading for every second. DHT11 is small in size with operating voltage from 3 to 5 volts. The maximum current used while measuring is 2.5mA. DHT11 sensor has four pins- VCC, GND, Data Pin and a not connected pin. A pull-up resistor of 5k to 10k ohms is provided for communication between sensor and micro-controller [4].

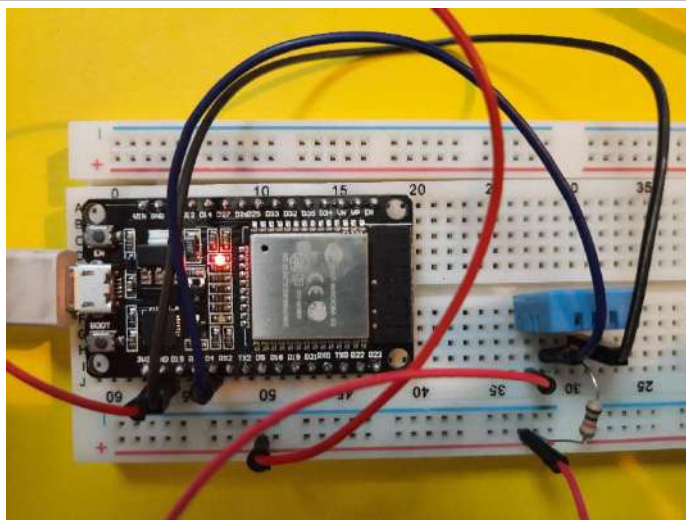


Figure 3 ESP32 and DHT11 setup

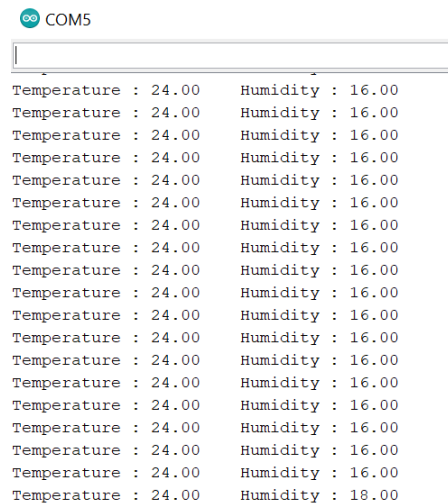


Figure 4 Screen shot of Arduino IDE serial monitor

2.2. Software

2.2.1. IoT cloud

For the IoT part, we have used Blynk 2.0 IoT Platform. Blynk is a full suite of software required to prototype, deploy, and remotely manage connected electronic devices at any scale: from personal IoT projects to millions of commercial connected products [5].

Blynk allow us to connect hardware to the cloud so we can display, store and visualize data from connected devices and even control the hardware remotely from anywhere in the world.

There are three main components to the platform:

- *Blynk App* - allows creation of interface for projects using a variety of drag and drop widgets (switch, slider, gauge, chart, etc.).
- *Blynk Server* - responsible for all communication between smartphones and microcontrollers.
- *Blynk Libraries* - allow communication with the server and process all input and output commands.

To provide exchange of data between hardware and Blynk mobile app, Blynk Inc. invented Virtual Pin (V0-V255). Virtual Pin can send data from the microcontroller to the Blynk App and receive it back without having to write a single line of code. So, with Virtual Pins we can read data from sensors, convert values, control servo and DC motors etc.

In order to become active in Blynk.Cloud each device should have a unique AuthToken. AuthToken is the main identifier of the device in the Blynk.Cloud. Depending on the hardware, connectivity, and the IoT use-case there are three ways to activate devices: manually create a device using Blynk.Console for initial prototyping, use Blynk.Inject for Wi-Fi-enabled devices, use Static Tokens for cellular, Ethernet, and other non-Wi-Fi connection methods [5].

There are several reasons why we chose Blynk among other IoT platforms. First, Blynk provides a database to store sensor readings so there is no need for a special SQL database. Second, Blynk provides a library for the Arduino IDE and third, maybe most importantly reason, Blynk provides HTTP APIs which can be used to get the sensor readings by simply calling them. This possibility has greatly facilitated the integration of AR and IoT.

Blynk provides an interactive dashboard where the user can build their own IoT projects by drag and drop widgets. The ESP32 collects the temperature and humidity data from DHT11 sensor and sends it to Blynk app. To display collected data, we use two Blynk Gauges widget. Temperature data are stored in virtual pin V0 and humidity data are stored in virtual pin V1. With Arduino IDE we write a code by which the temperature data from DHT11 sensors are sent to virtual pin V0 and Humidity data to Virtual pin V1.

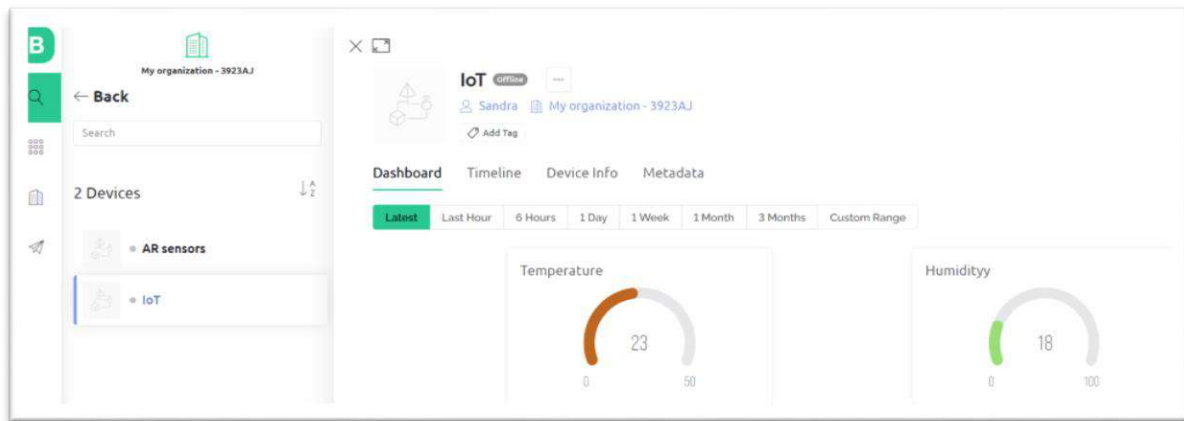


Figure 5 Blynk Dashboard on computer

Now we can monitor temperature and humidity data on Blynk mobile application.

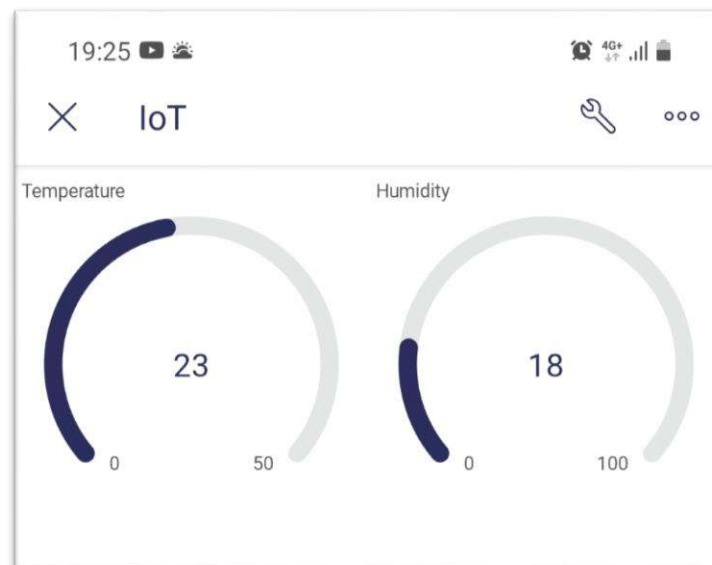


Figure 6 Blynk mobile application

AR application

For augmented reality part of the project, we have used Unity Hub software on our computer. Unity is a powerful cross-platform 3D engine originally intended for game development. Unity supports the C# programming language.

To create Augmented Reality in Unity it is necessary to use Vuforia. Vuforia is an augmented reality software development kit (SDK – Software Development Kit) for mobile devices that enables the creation of augmented reality applications. It uses computer vision technology to recognize target. The Vuforia SDK supports different types of targets, both 2D and 3D, including multi-target configurations, marker less image targets and frame markers.

Image Targets can be created with the Vuforia Target Manager using JPG or PNG images in RGB or grayscale. The size of the input images must be 2.25 MB or less and have a minimum width of 320 pixels. Features extracted from these images are stored in a cloud or device database, of which the latter can be downloaded and

packaged together with the application. Image Targets are detected based on natural features that are extracted from the target image and then compared at run time with features in the live camera image. The star rating of a target ranges between 1 and 5 stars. Although, targets with low rating (1 or 2 stars) can usually detect and track, aim for targets with 4 or 5 stars for best results [6].



Figure 7 Target image used in the project

The Vuforia developer library for Unity includes Google’s ARCore allowing AR applications on all modern android devices [7].

Virtual button (LOAD DATA, Figure 8) is used to load data from sensor in real-time AR. The input field object is used to display the temperature and humidity in real-time AR. Virtual button and two input field has been integrated with the APIs in C# script.

Blynk HTTP RESTful API allows to easily read and write values to/from Pins in Blynk apps and Hardware (microcontrollers and microcomputers like Arduino, Raspberry Pi, ESP8266, Particle, etc.). Every GET request will return current state/value on the given Pin [5].

The format of API is:

https://fra1.blynk.cloud/external/api/get?token=*****&pin

Whenever the virtual button is “pressed” the corresponding APIs will be called and the value of the temperature and humidity will be displayed in real time.

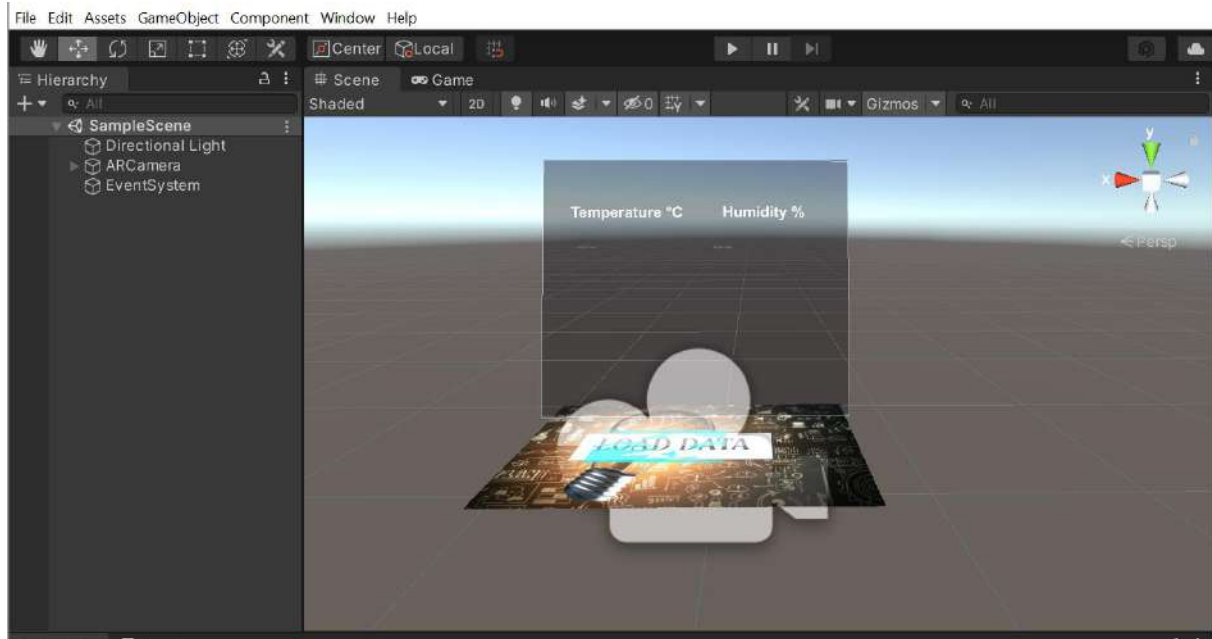


Figure 8 AR application build in Unity

The mobile application was built using Unity editor. Vuforia engine automatically generates the .APK file on smartphone using the android SDK. There is no UI in the mobile application, it opens the camera directly which contains a Vuforia watermark.

3. Conclusion

We successfully developed Augmented Reality app to monitor the sensor data supplied through ESP32. The ESP32 with DHT 11 are located in our office. The ESP32 is connected to the Blynk.Cloud and sends data to an Augmented Reality app. After pass our hand over LOAD DATA on target image the app projects the sensor data as the camera of the Android phone focus on a target image no matter where we are.



Figure 9 AR on mobile phone

AR is a powerful tool that can make a new dynamic user experience. We believe that AR is the future of digital world which are constantly evolving and that has great potential in the near future.

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SELECTION OF VERTICAL BEAM OF GLASS FACADE STRUCTURE

Igor Šuljić

University of Split, University Department of Professional Studies, Split, Croatia
isuljic@oss.unist.hr

Vladimir Vetma

University of Split, University Department of Professional Studies, Split, Croatia
vvetma@oss.unist.hr

Ivan Vrljičak

University of Split, University Department of Professional Studies, Split, Croatia
vrljicak@oss.unist.hr

Abstract. Demands and wishes placed on designers of metal structures by investors or clients are more and more of an aesthetic nature. For this reason, design, as a technical criterion for selection of a technical solution of the product, especially when the product is a glass facade structure of a tourist facility, takes a larger share in technical evaluation of products. Answer to solving this problem lies in the abstraction and finding solution between requirements and wishes with all the other technical criteria for selecting a technical solution of the product. This includes the necessary functionality, exploitability, technology and simultaneously contributing to the protection and preservation of the environment. It is a priority to achieve a functional product design that, along with economic validation, represents the optimal variant of the product. In this paper, process of selecting the load-bearing metal structure, primarily main vertical support of the glass facade structure, with respect to the above selection criteria, is presented. Also, for determined loads, a static calculation of the metal structure for selected materials is presented, in accordance with valid Eurocodes. The load-bearing profiles are dimensioned and the stable design of the selected system solution of the glass facade structure is presented. Results are presented for this system solution, in particular, the impact of different types of profiles on metal structure and its thermal features. Accordingly, the appropriate energy efficiency class is related to metal structure. Specialized programs, Schuco Statik and SchuCal +, and results of authorized institutions laboratory tests are used in this paper.

Key words: metal construction, glass facade, vertical beam, thermal features, statics

1. Introduction

All glass facade structures, and their associated elements must be designed in a way that they can withstand all operational loads, while respecting all rules, laws, norms, and standards. Glass facade constructions mainly consist of aluminium vertical beams, glass and components that connect the two elements. Due to their design and aesthetics, glass facade constructions are increasingly becoming the outer shell of modern building constructions. Extruded aluminium profiles are most often chosen for facade beams due to the wide range of different shapes and cross-sections of profiles. Extruded aluminium alloy profiles such as EN AW 6000, EN AW 6060, EN AW 6063, etc. are mainly used. The lower specific weight and ease of extrusion of very complex shapes and cross-sections of aluminium alloys is their main advantage over steel

profiles. Although the strength of aluminium is lower than the strength of steel, this shortcoming can be eliminated by careful design and selection of the appropriate cross section. Aluminium alloys are relatively cheap, have a long service life, they are resistant to corrosion, easy to shape and process, weldable, and subsequent heat treatments can improve their mechanical properties. In this paper, the selection and calculation of the vertical beam for the Hotel Osmine in Slano is presented. Depending on the operating load, it is necessary to perform a static calculation of the vertical beam, the selection of materials and control the load-bearing capacity and stability of the same, and to design joints between the beam and glass pane. To be safe and reliable, by properly designing and selecting the appropriate material using available and economically justified technologies and production, aluminium glass facade construction must withstand all loads to which it will be exposed. After checking the safety and reliability of the structure, it is necessary to choose a technical solution that meets the criteria of functionality, exploitation, technology, design and ecology. Aluminium glass facade constructions contribute to energy efficiency, which contributes to the protection and preservation of the environment. The technical solution must also meet the economic criteria set before the designers, by investors or clients. In view of all the above, we are guided by the choice of light construction of simple design and quick and easy installation.

2. Vertical beam - static calculation

The calculation of the vertical beam of a glass facade structure includes the calculation of load-bearing capacity and stability for constant load due to its own weight and the weight of the glass pane, and the calculation of load-bearing capacity and stiffness for variable load caused by wind. The calculation of constant load is performed according to HRN EN 1991-2-1, EN 1991-1-1, and the calculation of variable load according to HRN EN 1991-2-4, EN 1991-1-4 for wind load. These constant and variable loads cause stresses due to bending and buckling of the vertical girder (Figure 1).

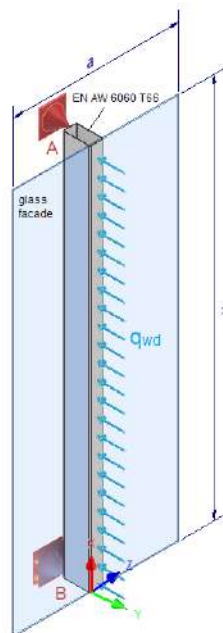


Figure 1 Wind load on vertical beam

2.1 Constant load calculation

The calculation of the constant load includes the calculation of buckling, i.e., the control of the stability of the vertical beam due to the action of the own weight of the beam and the glass pane. Under such load beam acts as a pressure element and must be checked for buckling and bending or torsional buckling and bending using the following equation

$$\frac{N_{Ed}}{N_{b,Rd}} \leq 1.0 \quad (1)$$

where N_{Ed} is the design longitudinal compressive force which is the effect of the own weight of the beam and the glass pane, and $N_{b,Rd}$ is the design resistance of the pressure element to buckling. The design resistance of the pressure element to buckling is determined from equation

$$N_{b,Rd} = \kappa \cdot \chi \cdot \frac{A_{eff} \cdot f_o}{\gamma_{M1}} \quad (2)$$

where κ is the factor that takes into account the effect of attenuation due to welding ($\kappa = 1$ for extruded aluminium alloys), λ is the reduction factor for the considered buckling mode, A_{eff} is the design area of the profile ($A_{eff} = A$ for cross sections of class 1, 2 or 3), f_o is the yield strength at permanent deformation of 0.2%, a $\gamma_{M1} = 1.1$ is the partial resistance factor.

In the case of the Hotel Osmine object, the calculation of the constant load is not required because the choice of a suitable technical solution has avoided the potential buckling of the beam. The technical solution is shown in Figure 1. The vertical beam is firmly supported at the top in such a way that all displacements are prevented, node A, while at the bottom it is articulated and allowed to translate along the x-axis, node B. Also, buckling is prevented by horizontal connections and stiffeners and auxiliary supports. Since with this technical solution vertical beam hangs at node A, it is possible to check the tensile strength of the structural element made of aluminium alloy following the equation

$$\frac{N_{Ed}}{N_{t,Rd}} \leq 1.0 \quad (3)$$

where N_{Ed} is the design longitudinal tensile force which is the effect of the own weight of the beam and the glass pane, and $N_{t,Rd}$ is the design resistance of the cross section to the longitudinal tensile force. The design tensile strength of the structural element is determined from the equation for yielding along the element $N_{o,Rd}$

$$N_{t,Rd} = N_{o,Rd} = \frac{A_g \cdot f_o}{\gamma_{M1}} \quad (4)$$

where A_g is the gross cross section of the profile ($A_g = A$).

2.2 Variable load calculation

The calculation of variable load due to the action of wind is performed using the standard HRN EN 1991-2-1, EN 1991-1-1, which also includes national specifics, National Appendices, which include natural phenomena characteristic of the Republic of Croatia. National supplements have a special significance for the islands and the coast, exactly where the Hotel Osmine object is located, which is the subject of this paper. Otherwise, in addition to earthquakes, the action of wind is the dominant load to which structures are exposed during their lifetime [2].

Following [3], the basic pressure caused by the wind speed q_b and the basic wind speed v_b are related by the equation

$$q_b = \frac{\rho}{2} \cdot v_b^2 \quad (5)$$

where $\rho = 1.25 \text{ kg/m}^3$ is recommended value of air density to be used. The basic wind speed v_b is calculated from equation

$$v_b = v_{b,0} \cdot c_{dir} \cdot c_{season} \quad (6)$$

where $v_{b,0}$ is the basic value of the basic wind speed which is defined as the characteristic ten-minute average wind speed at a height of 10 m above the terrain of a certain roughness category. It is determined from the map of the distribution of the basic value of the basic wind speed $v_{b,0}$ according to the areas shown in Figure 2. and is prescribed by the State Institute for Standardization and Metrology of the Republic of Croatia.

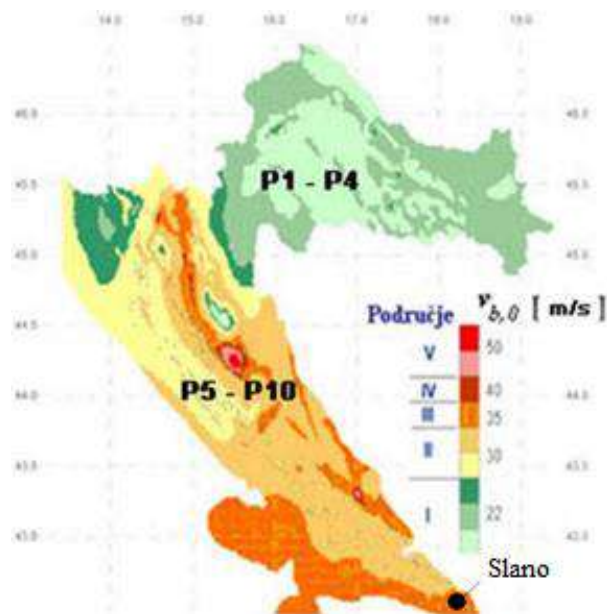


Figure 2 Map of wind load area and distribution of basic values of basic wind speed $v_{b,0}$ for Croatia [3]

The value of $c_{dir} = c_{season} = 1$ is usually adopted for the wind direction coefficient c_{dir} and the season-dependent coefficient c_{season} . The basic value of the basic wind speed

for Hotel Osmine is $v_{b,0} = 35$ m/s, because the location corresponds to the category of terrain roughness III. Also, it is necessary to determine the peak pressure caused by the wind speed $q_p(z)$, which depends on the height above the ground z and which includes average and short-term changes in wind speed. It is calculated according to the standard EN 1991-1-4: 2005 using the equation

$$q_p(z) = c_e(z) \cdot q_b \quad (7)$$

where $c_e(z)$ is the coefficient of wind exposure and is determined from the diagram shown in Figure 3. depending on the height of the structure above the ground z . This coefficient defines the wind conditions in the observed area, which are determined by geographical position. Surveys of wind activity have shown certain deviations from the

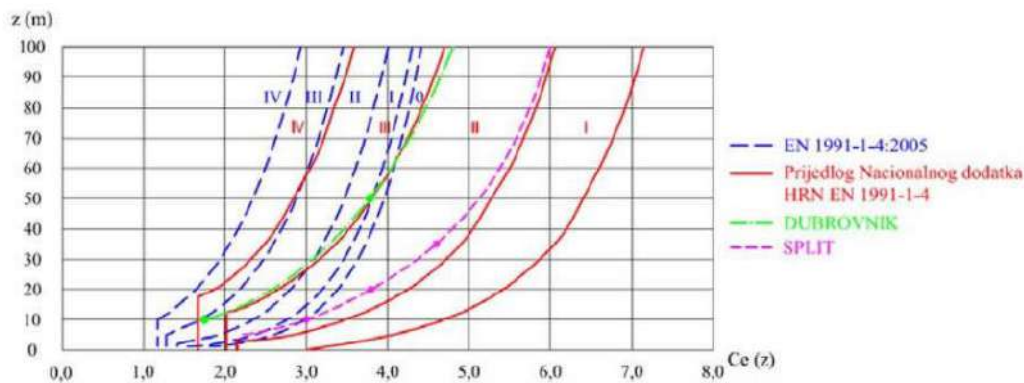


Figure 3 Wind exposure coefficient $c_e(z)$ depending on height of the structure above the ground z [3]

standard European values defined according to EN 1991-1-4: 2005, so the correction of the values covered by the National Application Appendix - HR EN 1991-1-4: 2005 has been made. As this is an orographically complex area that is also heavily influenced by the sea and the mainland hinterland, it would be of great importance to determine the actual values of the wind exposure coefficient $c_e(z)$ at as many locations as possible in the coastal and island areas of the Republic of Croatia. The diagram shows the wind exposure coefficient for large cities in Croatia, Dubrovnik and Split.

Calculated continuous load due to wind action q_{wd} is determined by algebraic summation of external and internal wind pressure ($w_e \pm w_i$) acting perpendicularly and simultaneously on the surfaces of structures [4] from equation

$$q_{wd} = (w_e \pm w_i) \cdot \gamma_Q \cdot a \quad (8)$$

where $\gamma_Q = 1.5$ is the partial safety factor for the case of variable load, and $a = 1.2$ m is the reference width of the glass pane taken over by the vertical beam. The wind pressure w_e acting on the outer surfaces of the structure is determined with

$$w_e = q_p(z) \cdot c_{pe} \quad (9)$$

where c_{pe} is the external pressure coefficient (Figure 4.).

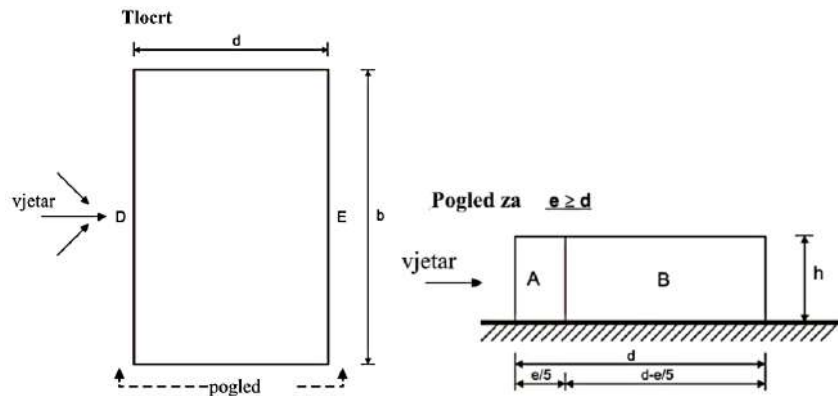


Figure 4 External pressure coefficient c_{pe} for vertical surfaces of rectangular floor plan structures [4]

The wind pressure w_i acting on the inner surfaces of the structure is determined from

$$w_i = q_p(z) \cdot c_{pi} \quad (10)$$

where c_{pi} is the internal pressure coefficient.

The coefficient of external wind pressure c_{pe} for structures and parts of structures depends on the shape and size of the surface of the loaded zone of the structure. For $A \geq 10 \text{ m}^2$, $c_{pe} = c_{pe,10}$ is valid (Table 1). Determining the value of the external pressure coefficient c_{pe} for vertical surfaces of rectangular floor structures is shown in Figure 4. and Table 1 according to 7.1 EN 1991-1-4, where $e = b$ or $2 \cdot h$ (smaller value) [4].

Table 1 External pressure coefficient c_{pe} for vertical surfaces of rectangular floor plan structures [4]

Area	A		B		C		D		E	
	$c_{pe,10}$	$c_{pe,1}$	$c_{pe,10}$	$c_{pe,1}$	$c_{pe,10}$	$c_{pe,1}$	$c_{pe,10}$	$c_{pe,1}$	$c_{pe,10}$	$c_{pe,1}$
5	-1,2	-1,4	-0,8	-1,1	-0,5		+0,8	+1,0	-0,7	
1	-1,2	-1,4	-0,8	-1,1	-0,5		+0,8	+1,0	-0,5	
$\leq 0,25$	-1,2	-1,4	-0,8	-1,1	-0,5		+0,7	+1,0	-0,3	

The coefficient of internal wind pressure c_{pi} for structures and parts of structures depends on the size and distribution of openings in the surface of the structure. If its not possible to determine the distribution of the openings μ , or its not considered appropriate to apply it, and if all the openings of the structure are closed under wind load, c_{pi} can be taken with the values $c_{pi} = +0.2$ or $c_{pi} = -0.3$ [4].

From the condition of bearing capacity or strength of the vertical beam

$$\frac{M_{zd}}{W_z} \leq \frac{f_o}{\gamma_{M1}} \quad (11)$$

derives the equation for the required cross section elastic resistance moment W_z

$$W_z \geq \frac{M_{zd} \cdot \gamma_{M1}}{f_o} \quad (12)$$

where M_{zd} is the design value of the bending moment

$$M_{zd} = \frac{q_{wd} \cdot h^2}{8} \quad (13)$$

Maximum deflection v_{max} of the vertical beam at the half length position follows

$$v_{max} \leq v_{dop} = \frac{h}{300} \leq 1.5 \text{ cm} \quad (14)$$

where, in the case of a continuous load due to the action of the wind, follows equation for maximum deflection

$$v_{max} = \frac{5 \cdot q_{wd} \cdot h^4}{384 \cdot I_z \cdot E} \leq 1.5 \text{ cm} \quad (15)$$

Therefore, we use the equation for the required cross section moment of inertia I_z

$$I_z \geq \frac{5 \cdot q_{wd} \cdot h^4}{384 \cdot E \cdot 1.5} \quad (16)$$

where h is the height of the beam and E is the Youngs modulus of elasticity.

3. Material selection

Materials most often used for vertical beams of glass facade structures are steel S235 and aluminium alloys EN AW 6060 T66. Steel and aluminium alloys for load-bearing structures should meet certain load-bearing and safety requirements. Steel S235 is a low-carbon structural steel that is not intended for post-heat treatment and meets the above requirements due to its high strength and toughness. Due to its low carbon content, it is suitable for welding, which is a very important technological feature when it comes to load-bearing structures. Steel S235 is not resistant to corrosion, so galvanizing is required, and it is suitable for use in the temperature range from -40 °C to +50 °C. Aluminium alloys have lower strength and other mechanical properties compared to steel, but their strength can be increased by heat treatment as in the case with aluminium alloy EN AW 6060 T66. However, other properties such as low specific weight, corrosion resistance, weldability, wide availability, and excellent machinability and forming ability are the advantages that aluminium alloys put ahead of steel when it comes to load-bearing structures. Aluminium beams in load-bearing structures are mainly produced by the extrusion process, which enables the production of a wide range of shapes and profiles, thus achieving the desired aesthetics of the structure, while saving materials. The most important properties of S235 steel and EN AW 6060 T66 aluminium alloy are shown in Table 2.

Table 2 Mechanical properties of steel S235 and aluminium alloy EN AW 6060 T66

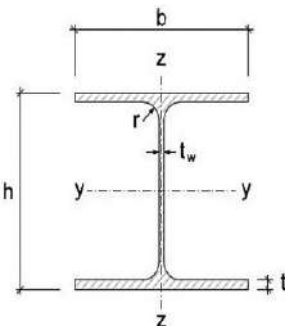
Material	Density ρ [kg/m ³]	Young's modulus E [GPa]	Yield Strength f_o [MPa]	Tensile Strength f_u [MPa]
S235	7860	210	235	360-510

EN AW 6060 T66	2700	70	160	215
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For example, Table 3 shows a comparison of the dimensions for beams made of steel S235 and aluminium alloy EN AW 6060 T66 bent-loaded that meet the condition of

load-bearing capacity and stability under load $F = 127.2$ kN. The beam length is 6 m.

Table 3 Dimensions of beam made of steel S235 and aluminium alloy EN AW 6060 T66 (I-profile)

Material	Depth h , [mm]	Width b , [mm]	Web thickness t_w , [mm]	Flange thickness t_f , [mm]	Root radius r , [mm]	
S235	300	150	7.1	10.7	15	
EN AW 6060 T66	300	195	10	25	15	

It was noticed that dimensions of beam made of aluminium alloy EN AW 6060 T66 are larger than the dimensions of the steel S235 beam. Also, the price of the steel beam is about 30% (~ 440.00 €) lower, while the aluminium alloy beam has about 22% (~ 55 kg) less weight. However, if we consider the investment in anti-corrosion protection of the steel beam of about 1 € / kg of steel (mass of the steel beam is ~ 253 kg), which is not required for aluminium one, their price is almost the same. In addition to all the above, it should be considered that aluminium beams, due to the possibility of extruding different shapes and cross-sections of the profile, can be supplied with already prepared grips for glass, while for steel beams they should be manufactured additionally. Also, the better thermal properties of aluminium compared to steel affect the thermal protection of metal structures and contributes to energy efficiency and protection, and preservation of the environment. Figure 5. shows the development of Schüco aluminium profiles with respect to the influence of the heat transfer coefficient of the aluminium profile U_f on the total heat transfer coefficient U_{cw} of glass facade structures whose beams are made of aluminium alloys. The total heat transfer coefficient of the aluminium glass facade U_{cw} for the object Hotel Osmine made with SchuCal + (U-Cal) is $U_{cw} = 1.2$ W/m²K, in accordance with the EnEv 2009 certificate.

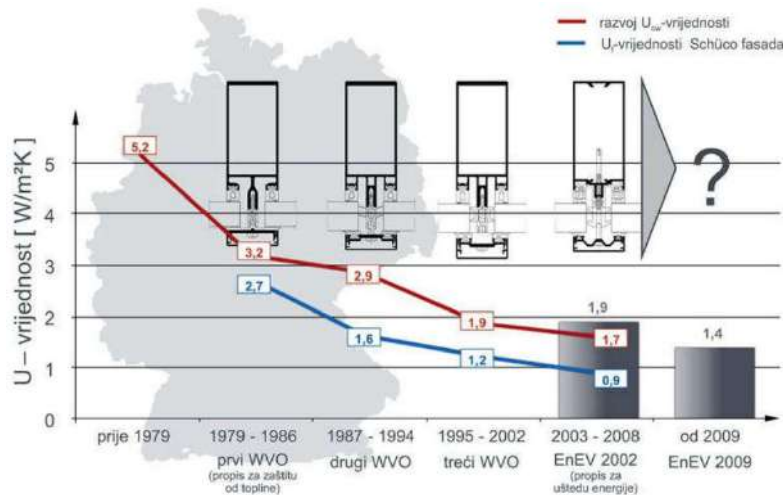


Figure 5 Development and influence of thermal features on thermal protection of structures with aluminium profiles [5]

4. Beam design in accordance with technical solution

For the load-bearing and stability condition to be met, a profile with appropriate geometry must be selected. The input parameter for further analysis is the calculated continuous load due to wind action q_{wd} . From equations (5), (6) and (7) and the basic values of the basic wind speed $v_{b,0} = 35 \text{ m/s}$ (Figure 2.) follows the peak pressure caused by the wind speed $q_p(z) = 1.148 \text{ kN/m}^2$ where the wind exposure coefficient $c_e(z) = 1.5$ is read from the diagram in Figure 3. For the ratio $h/d = 7 \text{ m}/15 \text{ m} = 0.467$ (d is width of the analysed structure of Hotel Osmine) according to Table 1 for area D, average external pressure coefficient $c_{pe} = +0.75$ is adopted. In the case of critical load, the coefficient of internal pressure $c_{pi} = -0.3$ is adopted, so from equations (9) and (10) follows the amount of wind pressure $w_e = 0.861 \text{ kN/m}^2$ and $w_i = -0.344 \text{ kN/m}^2$. The calculated continuous load follows from equation (8) and result is $q_{wd} = 2.169 \text{ kN/m}$.

The design value of the bending moment, equation (13), equals $M_{zd} = 13.285 \text{ kNm}$, so from equation (12) follows the minimum required moment of resistance $W_z \geq 91.33 \text{ cm}^3$, which will provide the required load-bearing capacity of the vertical beam to variable load due to the action of the wind. From equation (16) follows the minimum required moment of inertia $I_z \geq 6458.05 \text{ cm}^4$, which will ensure the required rigidity of the beam. In the mentioned equations $h = 7 \text{ m}$, $a = 1.2 \text{ m}$, $f_o = 160 \text{ MPa}$ and $E = 70 \text{ GPa}$ for aluminium alloys.

Aluminium profile EN AW 6060 T66, with appropriate geometry, has been proposed as a vertical beam of glass facade structure. The aluminium profile by Schüco manufacturer (Figure 6. b)) possesses appropriate load capacity, i.e., the moment of resistance $W_z = 129.91 \text{ cm}^3$ and is greater than minimum $W_z \geq 91.33 \text{ cm}^3$, but does not have the necessary rigidity because $I_z = 1759,43 \text{ cm}^4$ (Figure 7. - W_x, I_x).

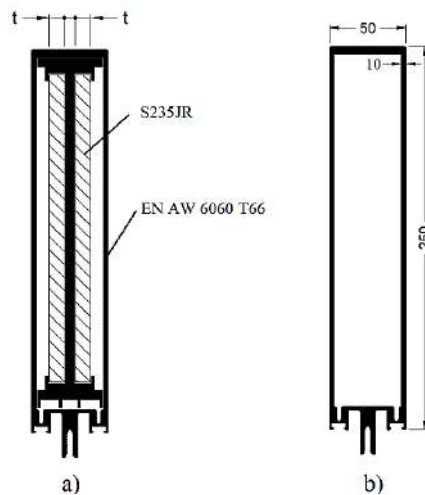


Figure 6 Aluminium profile cross section by manufacturer Schüco [6]

To achieve the required rigidity, manufacturer Schüco supplies an aluminium alloy insert for the profile shown in Figure 6. b), with a bearing for S235JR structural steel strips, as shown in Figure 6. a). This complex cross-section of the vertical beam with steel strips with a cross-section of 2 x 200 mm x 10 mm has the required stiffness, i.e., the moment of inertia $I_z = 7160.6 \text{ cm}^4$ is higher than required (Figure 8. - I_x).

Art.-Nr. Art. No.	mm	m	mm	mm	I_x	I_y	W_x	W_y
336 240	6,0	746	550	1759,43	93,83	129,91	37,53	
484 010	6,5	-	-	1401,13	12,5	122,43	5,61	

For all mullion profiles with 3 mm wall thickness, use suitable button T-cleats from the FWS 60 series.
To facilitate installation, coat insert profiles individually with wet paint (approx. 25 µm to 40 µm)

t	I_x	I_y	W_x	W_y
5	5160,6	107,6	269,5	43,0
6	5560,6	108,5	290,4	43,4
8	6360,6	111,5	332,2	44,6
10	7160,6	116,3	373,9	46,5

Zusätzliche Aussteifung durch Einsatz von je 2 x S235JR 200xt
Additional reinforcement provided by using 2 x S235JR 200xt

Figure 7 Geometry of profile from Fig. 6. b) Figure 8 Geometry of profile from Fig. 6. a)

However, due to economic reasons, this proposal was not accepted by the investor, so aluminium profile without insert (Figure 6. b)) was selected, to maintain the design and thermal efficiency criteria, while the S235J0 structural steel insert was made separately. Figure 9 shows a steel insert designed and manufactured by Vetma d.o.o. Steel insert with appropriate geometry is galvanized to prevent galvanic corrosion that could occur due to contact of two different metals, steel and aluminium, in the presence of moisture. Total moment of inertia of the cross section of the aluminium profile EN AW 6060 T66 and the insert made of steel S235J0 with a cross section of 212 mm x 20 mm equals $I_z = I_{Al} + n \cdot I_{S235J0} = 1759,43 + 3 \cdot 1588,02 = 6523,49 \text{ cm}^4$, and the moment of inertia of the designed cross section is greater than the required $I_z \geq 6458.05 \text{ cm}^4$. In the above expression I_{Al} is the moment of inertia of the aluminium beam, I_{S235J0} is the moment of inertia of the steel insert, and $n = 3$ is due to 3 times bigger the modulus of elasticity of steel compared to aluminium. Finally, the optimal cross section of the vertical beam was obtained, and the proposal of the technical solution was accepted by the investor.

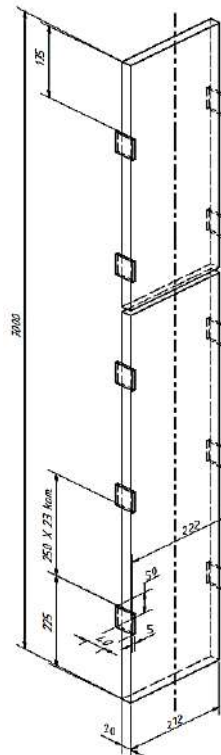


Figure 9 Steel S235J0 insert (Vetma d.o.o.)

Figure 10. presents installed glass facade construction of the Hotel Osmine located in Slano and assembly of the same.



Figure 10 Glass facade of Hotel Osmine in Slano

5. Conclusions

This paper presents the procedure for selection of a vertical beam of glass facade structure based on a static calculation. Wind action is the dominant load that occurs when it comes to load-bearing structures, and the local impact of wind action is covered

with the coefficient of wind exposure. The need for additional research, measurements, and analysis of the wind exposure coefficient for as many locations as possible was emphasized, in order to be able to more accurately determine the impact of wind on the metal structure during the construction phase. The selection of beam materials between steel and aluminium alloys, the most used materials for load - bearing structures, is presented. The requirements of the market and investors are to make the construction as cheap, as simple and as reliable as possible, also, if possible, with as less weight as possible. The paper presents numerous advantages of aluminium alloys in relation to steel, so the aluminium alloy EN AW 6060 T66 was selected as the beam material. Design of the vertical beam was performed in accordance with the standards and norms and was double checked by the specialized computer program SchucoStatik. The thermal features of aluminium and its alloys together with the glass make the energy-efficient glass facade construction in accordance with the latest standards. The thermal conductivity calculation was performed using the computer program SchuCal + (U-Cal). In the future, efforts should continue to be made to design energy-efficient structures to protect and preserve the environment.

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AUTOMATION OF SCREW COMPRESSOR

Ivan Vrljičak

University Department of Professional Studies, University of Split, Split, Croatia
vrljicak@oss.unist.hr

Igor Šuljić

University Department of Professional Studies, University of Split, Split, Croatia
isuljic@oss.unist.hr

Abstract. In this paper, the development of a program instruction that controls the operation of a screw compressor will be presented. Screw compressors (helical lobe compressors) is the type of gas compressors that fall into the category of rotary positive displacement compressors. Screw compressors are increasingly used in industries due to their high efficiency, reliability, small dimensions, high capacity and quietness compared to the other types of compressors. Work of screw compressor is controlled by an algorithm that is executed on Programmable Logic Controllers (PLC). PLC is an industrial digital computer that controls machines and industrial processes. Information's (pressure, temperature, flow, liquid level...) are taken from the environment by sensors. Sensor data are processed by PLC computer based on an algorithm. Output information from PLC is signal that controls actuators. An actuator is a device that produces a motion by converting energy. Actuators in screw compressors are electromotor, electromagnetic valves, pumps, switches... The PLC to be used to automate the operation of the compressor is Siemens Logo 8. The PLC program (program instruction) of the compressor is made with the Logo Soft Comfort software. For programming, the function block diagram (FBD) method was used. FBD is a graphical language for PLC.

Key words: screw compressors, PLC, sensors, actuators, function block diagram

1. Introduction

Practical application of this work is found during compressor maintenance and repairs. The most severe failure that can put the compressor out of operation is on the PLC. The mechanical parts (electromotor, valves, helical screw assembly) can work for years with proper maintenance. Individual parts such as sensors, actuators, pneumatic elements are relatively easy to replace. If a PLC failure occurs this is often a problem because the manufacturers no longer support maintenance (replacing the PLC with a belonging program instruction for that model of compressor) or the company no longer exists at all. This paper presents the process by which it is possible to create program instruction for a compressor and return it to operation condition.

Compressor that have a problem with PLC is Compair DH series water cooled screw compressor (Figure 2). This compressor is used for tennis court inflatable structure (Figure 1). It is oil free compressor in accordance to ISO-8573-1 that guaranteed air supply free of oil contamination [1]. Acquiring a new PLC with original program instruction was not possible so the only solution was to replace defective PLC and made a custom made program instruction. For creating a program instruction that controls the operation of the compressor, it is necessary to know the principle of operation of the device. The aggravating circumstance was the lack of original electrical circuit diagrams and manuals so similar compressor models manuals and

diagrams are used for familiarizing with machine. After that, the list of requirements that compressor automation must meet was set.



Figure 1 Inflatable structure



Figure 2 Compressor unit

The program instruction had to include functionalities such as setting the operating pressure, monitoring the change in pressure in real time, starting and stopping the process, lubrication and cooling, maintaining the operating temperature and monitoring the operating parameters. Special attention is paid to the safety of the compressor; preventing accidents that may occur in the event of errors in the process. Replacing PLC is Siemens Logo 8 and program instruction was made in Logo Soft Comfort software.

2. Operating principles of screw compressor

Screw compressor is positive displacement machine that compresses the air by reducing the volume of chamber by rotary movement. Rotary movement is realized by a set of male and female rotors that are meshed together (Figure 3). The male rotor has convex lobes and the female rotor has concave cavities. Convex and concave lobes meshed together forcing the gas through the volume between the male and female rotors (Figure 4). Compression is achieved by reducing the working area is the inter-lobe. Volume is larger at the intake and reduced along the length of the rotors. This change in volume results with the compression of air. Oil or water is used for sealing the compression cavities between male and female rotors.

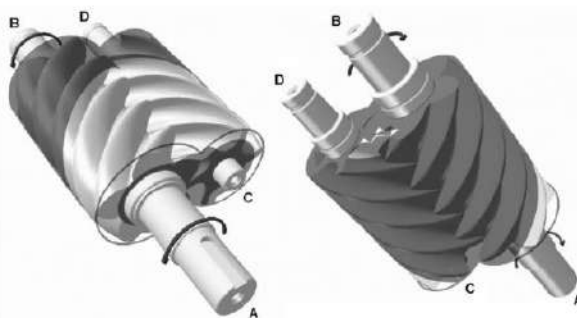


Figure 3 Screw compressor rotors [2]



Figure 4 Compressor elements [3]

Screw compressors are used in a wide variety of applications including air compression, gas refrigeration, hydrocarbon processing and power utilization from

low-grade heat sources [4]. Sizes range from small workshop air compressors to 8,400 kW heavy industrial compressors with output pressures as high as 60 bar [5]. The operation of screw compressor and compressor parts are described in the following schematics view (Figure 5).

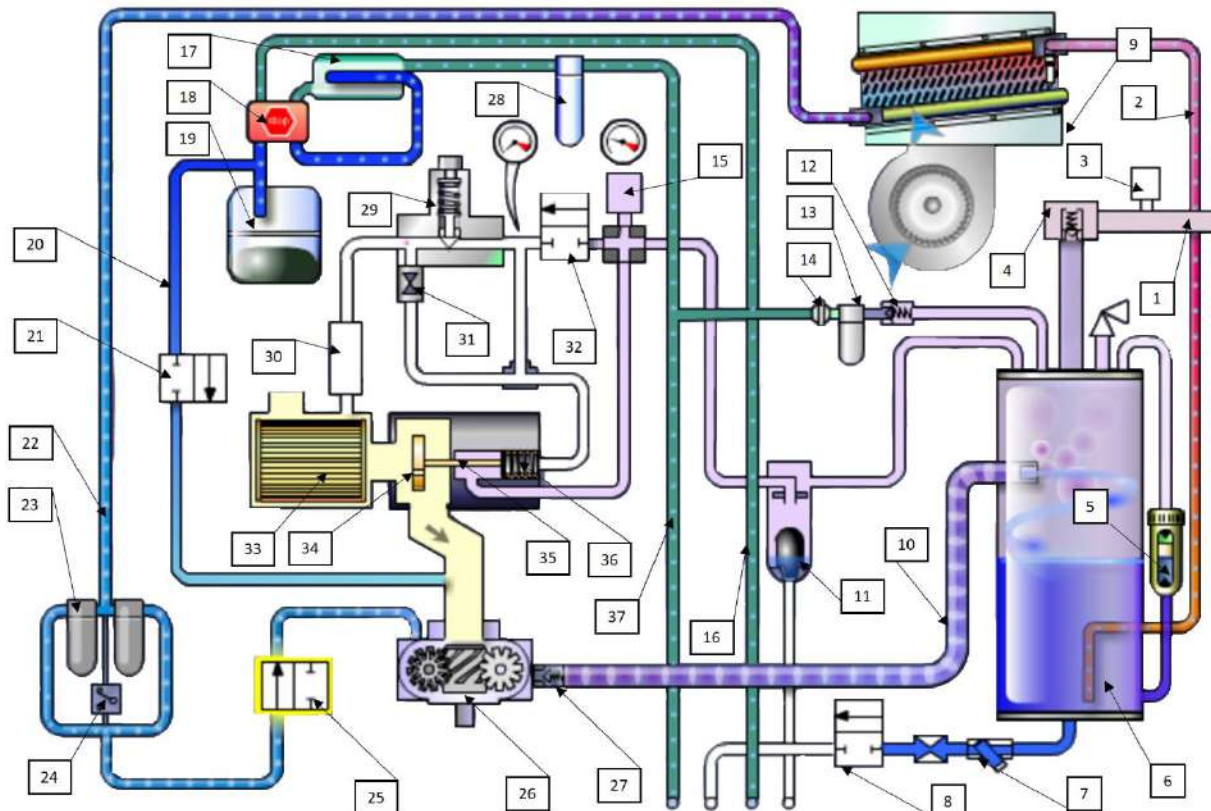


Figure 5 Schematic view of Compair DX screw compressor operations [6]

The function of all screw compressor components marked with positions in the schematic view is explained in the following text.

- 1 – Air line to the pressure vessel.
- 2 - Reclaimed water to water cooler.
- 3 - Pressure transmitter: transmitter monitors the pressure for control of the load and unload values.
- 4 - Minimum pressure/non-return valve: this valve ensures a rapid pressure build up in the separator vessel during initial start-up and non-return valve prevents pressurised air in the user pipework passing back into the separator vessel.
- 5 – Water level switch: monitors the injection water level in the separator vessel.
- 6 – Separator vessel: separate water from the air by centrifugal action and gravity.
- 7 – Water drain manual valve.
- 8 – Solenoid valve of the water drain: solenoid drains water if the level within the separator vessel exceeds the high switching level.
- 9 – Water cooler: cools the water before being returned to the compression element.

- 10 – Compression element/ air water discharge: the air and water mixture is discharged from the compression element into the separator vessel.
- 11 – Airline filter: this filter removes moisture from the control air which is used for opening and closing the suction intake valve.
- 12 – Reverse osmosis non-return valve: this valve protects unit and mains water supply from a back pressure.
- 13 – Water demineralisation filter: filter ensures that the water quality is at correct levels during filling and commissioning.
- 14 – Water fill valve: this is used for the initial fill of water, during commissioning and recommissioning procedures.
- 15 – Pressure transmitter internal: this transmitter monitors the compression element discharge pressure.
- 16 – Waste water discharge line.
- 17 – Reverse osmosis membrane filter: this filter removes all impurities including salts, minerals, organisms and other dissolved and suspended solids.
- 18 – Diaphragm pump: uses water pressure to fill the treated water storage tank.
- 19 – Treated water storage tank: purified water is stored in the storage tank until is required by the compressor.
- 20 – Top up water line: water flows into the system from the treated water tank when the water level is low enough to trigger the water level switch.
- 21 – Solenoid valve: this solenoid allows purified water from the storage tank to enter the compression element when required.
- 22 – Water cooler to injection filter: returns water to the injection filter prior to re-use by the compressor element.
- 23 – Injection water filter: filters separated water before being returned to the compression element.
- 24 – Differential pressure switch: monitors the filters saturation and the water pressure.
- 25 – Water stop solenoid valve: prevents water from the cooler draining back into the compression element when the unit is stopped.
- 26 – Compression element: single screw compression element comprises a single screw main rotor with 6 flutes that mesh with two gate rotors with 11 teeth.
- 27 – Non-return valve: prevents air and water passing back into the compression element when the compressor stops (hydraulic shock).
- 28 – Reverse osmosis pre-filter: removes chlorine and large particles.
- 29 – Blowdown control valve: this is minimum pressure valve that maintains a pressure of 3 bar within the system during off-load running.
- 30 – Blow down dump silencer: this component silences the pressurised air that is dumped from the system whilst it is off load.
- 31 – Blow down restrictor: component allows air to by-pass the blowdown control valve and is exhausted out through the intake valve.
- 32 – Solenoid valve load/unload: this valve controls the loading and unloading of the compressor.

33 – Intake air filter.

34 – Intake valve and start valve: the intake valve comprises two small start valves that allow a small amount of air into the system when the valve is closed (compressor running off load). This prevents a vacuum being created in the compressor element.

35 – Suction intake valve: this valve controls the flow of air entering the compression element.

36 – Diaphragm control chamber: this is a piston and spring configuration that uses air from the separator vessel to control the opening and closing of the suction intake valve by solenoid (position 32).

37 – Incoming water supply: incoming water should be potable (drinking) with pressure from 2.2 to 6 bar.

3. Requirement list

After considering the principle of operation of the screw compressor in the previous chapter, the following requirements are set for the compressor automation system:

- Option to adjust the operating pressure between 5 and 15 bar. The set operating pressure, in this case, represents the maximum pressure in the compressed air tank. Differential (minimum pressure) is 2 bar less than maximum. The presence of differential pressure prevents frequent on/off switching of the compressor due to pressure oscillations around the set point.
- The pressure in the air tank is monitored (Figure 5, position 3) and based on this information, the solenoid that controls the operation of the inlet valve is activated (Figure 5, position 32).
- The water level in the separator is monitored (Figure 5, position 6). In case of excess water, the discharge solenoid valve is activated, which releases water from the separator (Figure 5, position 8). If there is a lack of water in the separator, the solenoid valve is activated (Figure 5, position 21).
- The water pressure used to lubricate and cool the compressor screw is monitored (Figure 5, position 24). In the event of a drop in water pressure, the compressor must be stopped. It is also necessary to protect the compressor from hydraulic shock which can occur by collecting water in the chamber where the screws are located (Figure 5, position 25). In the event of an error, an alarm is activated and message is shown on the screen.
- If the temperature of the water used to lubricate the compressor screws is exceeded, the air cooler fan is activated. The water is maintained at a temperature between 60 and 90 °C.
- The saturation of the water filter is measured by differential pressure. In the event of filter saturation, an alarm is activated to prevent the compressor from starting.
- If the maximum pressure is exceeded, the PLC stops the operation of the compressor and the alarm is activated.
- It is necessary to adequately protect the electric motor of the compressor. The electric motor is the most expensive component of the system and special attention should be paid to its protection. Since the compressor motor is a three-phase asynchronous electric motor, there is a risk of one or more phases failing, which

can destroy the motor. Also, stator windings may overheat due to excessive currents, which can occur due to bearing failures, motor overloads... The winding temperature is monitored via a temperature probe. When an unauthorized temperature rise occurs, the compressor automatically stops and the alarm on the display is activated.

- The PLC screen shown the operating parameters of the compressor. It is also possible to change some of the parameters of the compressor. An alarm message is displayed if the error occurs.

4. Program instruction

The program instruction based on the requirements list is developed in Logo Soft Comfort V8 software designed by Siemens AG. A FBD (functional block diagram) module was used for programming instructions. FBD is a graphical language for PLC. A function in FBD is described as a set of elementary blocks. Input and output variables are connected to blocks by connection lines. FBD programming language is defined by IEC 61131-3 standard [7]. In the following figure (Figure 6) a graphical representation of the program instruction is shown.

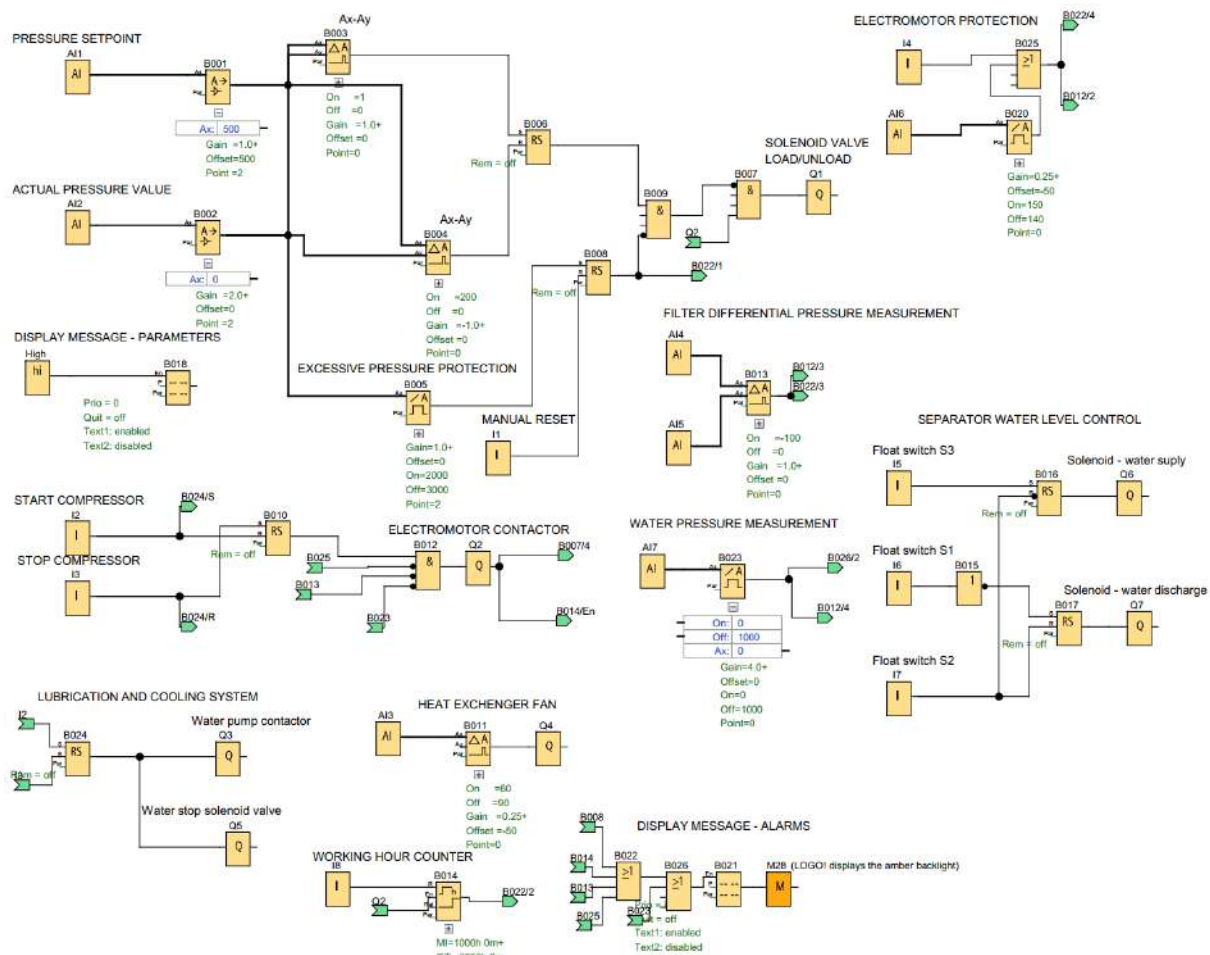


Figure 6 Graphical representation of the program

As it can be seen the program consists of several subunits. The function of individual units is further described in the text. Main part of program instruction (Figure 7) controls

the air pressure. Actual air pressure is measured by an analog sensor (Figure 5, position 3). Required pressure is set on Logo device by keys input. If the actual air pressure is lower than required pressure load/unload solenoid valve is activated and the intake valve is opened. The air pressure rises until the required and actual pressure are equal. Then the intake valve is closed. Differential (minimum pressure) is 2 bar less than maximum. The presence of differential pressure prevents frequent on/off switching of the compressor due to pressure oscillations around the set point. Differential pressure is set by B003 and B004 blocks in the program (analog comparator). In case of excessive pressure (malfunction) the protection is activated by block B005. This allows the compressor to start only after the malfunction has been removed and the manual reset (taster I1) was done.

Starting and stopping the compressor is done via the tasters represents by blocks I2 and I3 (digital inputs). Starting the compressor is only possible when the following conditions are met: there is no problem with electrical supply, water level in separator is within limits and water pressure is satisfactory (3 to 4 bars). Start/stop tasters also run water pump.

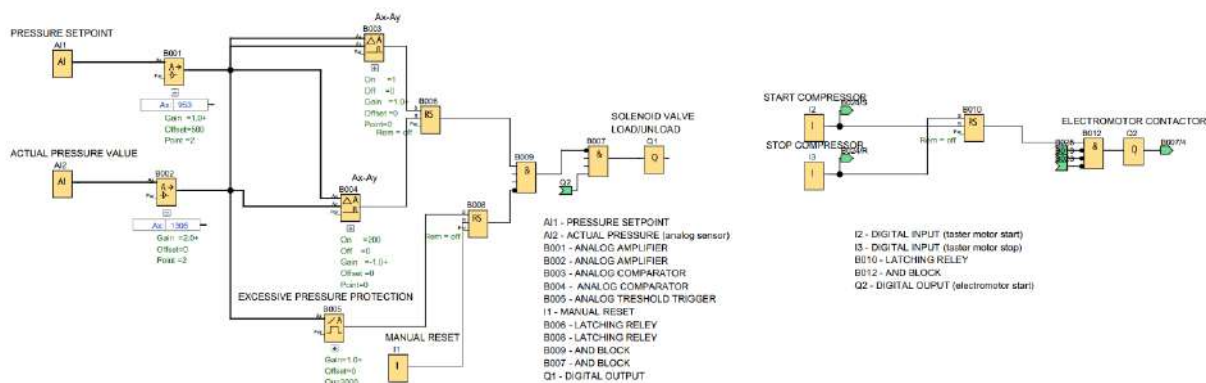


Figure 7 Main part of the program instructions

The lubrication and cooling system is done by a water pump which is started by contactor via PLC (Figure 8). Water temperature is monitored by Pt100 analog sensor. When the temperature of the water is reached heat exchanger fan contactor is activated. The water is maintained at a temperature between 60 and 90 °C. Water filter saturation is monitored by two pressure sensors (AI4, AI5). When the filter is saturated, an alarm message is shown on display. Electromotor is protected by measurement of stator winding temperature. Missing current phase can also be detected.

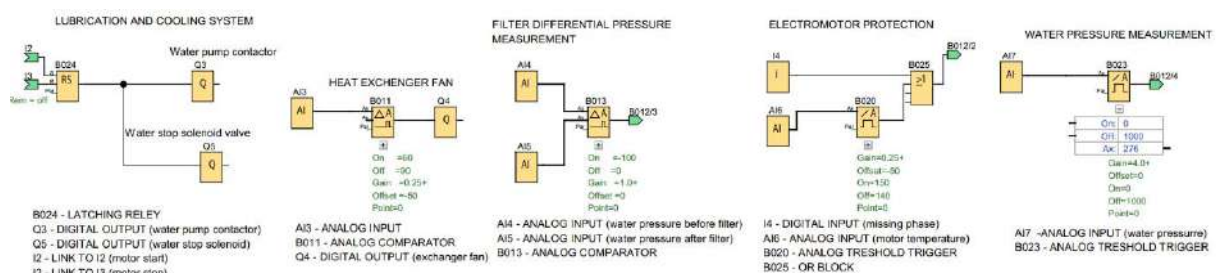


Figure 8 Program instruction

The water level control system works on the principle of activating the water supply solenoid when there is no sufficient water in the separator and discharging when there is too much water (Figure 9). Water level monitoring was performed using four electrodes of different lengths (I5, I6, I7 and earthing electrode). Water closes an electric circuit when the liquid reaches a certain level and thus control the operation of the system.

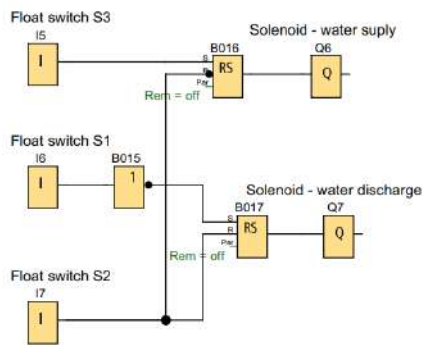


Figure 9 Separator water level control

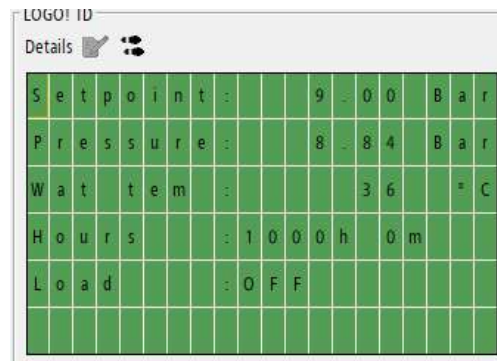


Figure 10 Display message

Blocks B018 and B021 determine what will be displayed on the Logo device. The presentation consists of two parts. The screen with operating parameters is in the foreground (Figure 10). In the event of an error in the system, the alarm display is activated and it comes to the forefront of the screen until the error is removed.

5. Conclusion

In this paper, the possibility of repairing a screw compressor is presented. The problem was caused by a malfunction on the PLC. The impossibility of acquiring a replacement part and the associated program instructions conditioned the replacement of the PLC and the development of the new program instructions. The aggravating circumstance was the lack of service manual and electrical circuit diagrams of the device. The replacement PLC is the Siemens Logo 8. Based on the introduction to the compressor work principles, a list of requirements that the automation system must meet has been set. The replacement program instruction was made in Siemens Logo Soft Comfort. The result was that the compressor regained its full functionality.

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NUMERICAL IMPLEMENTATION OF THE DISPLACEMENT AND FORCE METHOD IN THE ANALYSIS OF THE BEAM STRUCTURES

Frane Vlak, Stipe Latinac
University of Split, FESB, Split, Croatia
fvlak@fesb.hr, stipe.latinac.00@fesb.hr

Ado Matoković, Boris Mikulić
University of Split, University Department of Professional Studies, Split, Croatia
amatokov@oss.unist.hr, bmikulic@oss.unist.hr

Abstract. Despite the rapid progress of the computing equipment and numerical analysis software, the analytical methods are still valuable tool for analysis of the beam structures appearing in many engineering fields: mechanical engineering, civil engineering, naval architecture, etc.. The displacement and the force methods are probably the most frequently used methods for that purpose, particularly in the situations where degree of the statical or kinematical indeterminacy is higher than two. The numerical implementation of these methods using MATLAB or OCTAVE computing platform is presented in this paper. Since the force and the displacement methods are basically represented in the matrix form, the use of MATLAB and its freeware alternatives arises naturally because these platforms are primarily oriented to deal with matrices and different forms of the matrix manipulations. Additionally, the ease of data visualisation makes these platforms suitable for the graphical representation of the solutions obtained by the force and displacement method. The developed in-house code can be used as an auxiliary tool for the check of the analytical procedures and, in extension, in many other aspects of structural analysis such as structural optimization. The short theoretical explanation of the matrix formulation for both methods is followed by few examples of the different types of the beam structures using full benefits of the MATLAB visualisation capabilities.

Key words: structural analysis, beams, FEM, MATLAB

1. Introduction

Almost every engineering study program contains at its beginning semesters Mechanics of Materials (MoM) course where students are learning basics of design principles and structural analysis. This fundamental course is often followed by course where the principles, previously explained in MoM, are numerically implemented, usually within the Finite Element Method (FEM). During their long-term teaching experience, the authors of this paper realized that the link between these two courses can be effectively presented in the form of the simple and direct numerical implementation of the force and displacement method [1-9] that are used for structural analysis of the various types of the beam structures. Since these methods are frequently presented in the matrix form, the use of the MATLAB [10] or some of its freeware alternatives like OCTAVE as programming and numeric computing platform, is established naturally.

2. Numerical implementation of the displacement method and the force method

Since the generation of the displacement method primary system is unique and straightforward by restraining appropriate nodal displacements, its numerical implementation via FEM is simple and effective. The equilibrium of two noded beam finite element [2-7] is defined in local coordinate system as

$$\mathbf{k}^e \mathbf{d}^e = \mathbf{p}^e + \mathbf{p}_{ekv}^e \quad (1)$$

where \mathbf{d}^e is local element displacement vector, \mathbf{p}^e is vector of element nodal loads corresponding to the element displacements. Matrix \mathbf{k}^e is element stiffness matrix and its definition for Timoshenko beam can be found in [2,11]. The vector $\mathbf{p}_{ekv}^e = \left[(\mathbf{p}_{A,ekv}^e)^T (\mathbf{p}_{B,ekv}^e)^T \right]^T$ is vector of equivalent nodal loads due to element distributed loads where these equivalent nodal loads, at first element node A and second element node B for linearly distributed load (defined with q_{xA} , q_{yA} , q_{zA} at node A and q_{xB} , q_{yB} , q_{zB} at node B) along Timoshenko beam element, are

$$\mathbf{p}_{A,ekv}^e = \left[\frac{l}{6} q_{x1}^{ekv} \quad \frac{l}{20} q_{y1F}^{ekv} \quad \frac{l}{20} q_{z1F}^{ekv} \quad 0 \quad -\frac{l^2}{60} q_{z1M}^{ekv} \quad \frac{l^2}{60} q_{y1M}^{ekv} \right]^T$$

$$\mathbf{p}_{B,ekv}^e = \left[\frac{l}{6} q_{x2}^{ekv} \quad \frac{l}{20} q_{y2F}^{ekv} \quad \frac{l}{20} q_{z2F}^{ekv} \quad 0 \quad -\frac{l^2}{60} q_{z2M}^{ekv} \quad \frac{l^2}{60} q_{y2M}^{ekv} \right]^T \quad (2)$$

where $q_{x1}^{ekv} = 2q_{xA} + q_{xB}$; $q_{x2}^{ekv} = q_{xA} + 2q_{xB}$; $q_{y1F}^{ekv} = k_1 q_{yA} + k_2 q_{yB}$; $q_{y2F}^{ekv} = k_2 q_{yA} + k_1 q_{yB}$; $q_{z1F}^{ekv} = k_3 q_{zA} + k_4 q_{zB}$; $q_{z2F}^{ekv} = k_4 q_{zA} + k_3 q_{zB}$; $q_{z1M}^{ekv} = k_5 q_{zA} + k_6 q_{zB}$; $q_{z2M}^{ekv} = k_6 q_{zA} + k_5 q_{zB}$; $q_{y1M}^{ekv} = k_7 q_{yA} + k_8 q_{yB}$; $q_{y2M}^{ekv} = k_8 q_{yA} + k_7 q_{yB}$; $k_1 = (7 + 80k_y)/(1 + 12k_y)$; $k_2 = (3 + 40k_y)/(1 + 12k_y)$; $k_3 = (7 + 80k_z)/(1 + 12k_z)$; $k_4 = (3 + 40k_z)/(1 + 12k_z)$; $k_5 = (3 + 30k_z)/(1 + 12k_z)$; $k_6 = (2 + 30k_z)/(1 + 12k_z)$; $k_7 = (3 + 30k_y)/(1 + 12k_y)$; $k_8 = (2 + 30k_y)/(1 + 12k_y)$ with $k_y = \kappa_y EI_z / (GA l^2)$, $k_z = \kappa_z EI_y / (GA l^2)$ and κ_y and κ_z as shear factors [1].

With transformation matrix \mathbf{T} , that actually describes rotation from global OXYZ to element local Axyz coordinate system and is consisted of cosines of local element direction angles, the local element displacements are related to the global element displacements \mathbf{Z}^e as $\mathbf{d}^e = \mathbf{TZ}^e$. Premultiplying Eq. (1) with \mathbf{T}^T , the element equilibrium in global coordinate system is obtained

$$\mathbf{K}^e \mathbf{Z}^e = \mathbf{P}^e + \mathbf{P}_{ekv}^e \quad (3)$$

where $\mathbf{K}^e = \mathbf{T}^T \mathbf{k}^e \mathbf{T}$, $\mathbf{P}^e = \mathbf{T}^T \mathbf{p}^e$ and $\mathbf{P}_{ekv}^e = \mathbf{T}^T \mathbf{p}_{ekv}^e$. By appropriate numeration of the nodal degrees of freedom (DOF) to obtain relationship between element \mathbf{Z}^e and structural displacements \mathbf{Z} in the form $\mathbf{Z}^e = \mathbf{AZ}$ (rectangular matrix \mathbf{A} is a rectangular reordering matrix [2-4] in which every row consists of zeros except for a single term of unity, the position of which identifies that element of \mathbf{Z}^e which corresponds to the

particular element of global structure displacements \mathbf{Z}), it is possible to assemble global equation system that is usually splitted into two subsystems

$$\begin{bmatrix} \mathbf{K}_{ii} & \mathbf{K}_{ij} \\ \mathbf{K}_{ji} & \mathbf{K}_{jj} \end{bmatrix} \begin{Bmatrix} \mathbf{Z}_i \\ \mathbf{Z}_j \end{Bmatrix} = \begin{Bmatrix} \mathbf{Q}_{F,i} + \mathbf{Q}_{Fekv,i} \\ \mathbf{Q}_{F,j} + \mathbf{Q}_{Fekv,j} \end{Bmatrix} \quad (4)$$

in order to separate vector of unknown displacements \mathbf{Z}_i from \mathbf{Z}_j as known ones (defined with n_{BC} boundary conditions), and known nodal forces $\mathbf{Q}_{F,i} + \mathbf{Q}_{Fekv,i}$ from the unknown ones. In this case, the vector \mathbf{Z}_i , defined in global coordinate system, can be calculated as

$$\mathbf{Z}_i = \mathbf{K}_{ii}^{-1} (\mathbf{Q}_{F,i} + \mathbf{Q}_{Fekv,i}) - \mathbf{K}_{ij} \mathbf{Z}_j \quad (5)$$

Respective reactions at the supports are

$$\mathbf{R} = \mathbf{Q}_{F,j} = \mathbf{K}_{ji} \mathbf{Z}_i + \mathbf{K}_{jj} \mathbf{Z}_j - \mathbf{Q}_{Fekv,j} \quad (6)$$

In the approach for the force method adopted in this paper, the forces \mathbf{p}_{Bt}^e at the element second node B are chosen as the structural unknowns. That forces includes internal forces \mathbf{p}_B^e and $\mathbf{p}_{B,ekv}^e$ as equivalent element loads at that node, i.e.

$\mathbf{p}_{Bt}^e = \mathbf{p}_B^e + \mathbf{p}_{B,ekv}^e$. The element forces $\mathbf{p}_t^e = \left[(\mathbf{p}_{At}^e)^T \quad (\mathbf{p}_{Bt}^e)^T \right]^T$, defined in local coordinate system are determined using $\mathbf{p}_t^e = \mathbf{b}^e \mathbf{p}_{Bt}^e$ where \mathbf{b}^e is element equilibrium matrix [2,3]. Furthermore, the equilibrium equations for the analysed beam system can be represented as

$$\mathbf{A}^T \mathbf{B} \mathbf{p}_{Bt} + \mathbf{n}_R \mathbf{p}_R = \mathbf{Q}_F + \mathbf{Q}_{Fekv} \quad (7)$$

where $\mathbf{p}_{Bt} = \left[(\mathbf{p}_{Bt}^{e_1})^T \quad (\mathbf{p}_{Bt}^{e_2})^T \quad \dots \quad (\mathbf{p}_{Bt}^{e_m})^T \right]^T$ is vector of the forces at every element second node that are adequately numerated for all m elements. Vector \mathbf{p}_R represents the vector of the reaction complements at the structure supports while $\mathbf{B} = \text{diag}(\mathbf{B}^{e_1}, \mathbf{B}^{e_2}, \dots, \mathbf{B}^{e_m})$ is diagonal matrix consisted of the matrices $\mathbf{B}^e = \mathbf{T}^T \mathbf{b}^e$. For the element forces vector in global coordinate system $\mathbf{P}^e = \mathbf{B}^e \mathbf{p}_{Bt}^e$, defined for the whole structure as $\mathbf{P} = \left[(\mathbf{P}^{e_1})^T \quad (\mathbf{P}^{e_2})^T \quad \dots \quad (\mathbf{P}^{e_m})^T \right]^T$, it is possible to express it as $\mathbf{P} = \mathbf{B} \mathbf{p}_{Bt}$. With $\mathbf{n}_i = \mathbf{A}^T \mathbf{B}$ and \mathbf{n}_R as matrices of the direction cosine vectors of \mathbf{p}_{Bt} and \mathbf{p}_R , the multiplications $\mathbf{n}_i \mathbf{p}_{Bt}$ and $\mathbf{n}_R \mathbf{p}_R$ represents the projections of the force vectors to the global coordinate system axes. It should be noted that the forces \mathbf{p}_{Bt} and redundants \mathbf{p}_R represent both the statically determinate and redundant forces and reactions [2]. For n structural nodes, the statical indeterminacy is $D = 6m + n_{BC} - 6n$. For statically indeterminate systems ($D > 0$), the equilibrium equation (7) can be transformed into

$$[\mathbf{n}_0 \quad \mathbf{n}_X] \mathbf{Q} = \mathbf{Q}_F + \mathbf{Q}_{Fekv} \quad (8)$$

or

$$\mathbf{Q} = [\mathbf{Q}_0^T \quad \mathbf{X}^T]^T = \mathbf{b}_0(\mathbf{Q}_F + \mathbf{Q}_{Fekv}) + \mathbf{b}_X \mathbf{X} \quad (9)$$

where \mathbf{Q}_0 is vector of the forces \mathbf{p}_{Bt} and reaction complements \mathbf{p}_R of the force method primary system while \mathbf{X} corresponds to the redundant forces and reaction complements. The columns of the matrix $\mathbf{b}_0 = [(\mathbf{n}_0^{-1})^T \quad \mathbf{0}]^T$ represents the internal forces of the primary system due to unit given loads, while columns of the matrix $\mathbf{b}_X = [(-\mathbf{n}_0^{-1}\mathbf{n}_X)^T \quad \mathbf{I}]^T$ are internal forces due to unit redundant forces. Compared to the displacement method, the adoption of the force method primary system is not a unique task, and the main challenge in the numerical implementation of the force method is automatic determination of the primary system without any user intervention. In this approach, described in detail in [1], the matrix $[\mathbf{n}_0 \quad \mathbf{n}_X]$ is augmented with unit matrix \mathbf{I} to obtain $[\mathbf{n}_0 \quad \mathbf{n}_X \mid \mathbf{I}]$. For 3D problem, and using jordanian elimination technique i.e. jordanian transformation matrices \mathbf{J} [2], it is possible to obtain

$$\mathbf{J}_{6n} \mathbf{J}_{6n-1} \mathbf{L} \mathbf{J}_2 \mathbf{J}_1 [\mathbf{n}_0 \quad \mathbf{n}_X \mid \mathbf{I}] = [\mathbf{I} \quad \mathbf{n}_0^{-1} \mathbf{n}_X \mid \mathbf{n}_0^{-1}] \quad (10)$$

It is essential to memorize what columns are interchanged during this procedure because each column corresponds to the particular element force or redundant. This means that the first $6n$ columns of the 3D resulting matrix in Eq. (10) are related to the primary system forces, and the next n_{BC} columns are related to the redundant forces. For statically indeterminate problem, compatibility equations are

$$\mathbf{b}_X^T \mathbf{F} \mathbf{Q} = \mathbf{0} \quad (11)$$

where \mathbf{F} is flexibility matrix of unassembled structure, i.e. $\mathbf{F} = \text{diag}(\mathbf{f}^{e_1}, \mathbf{f}^{e_2}, \dots, \mathbf{f}^{e_m}, \mathbf{f}_R)$, consisted of the flexibility matrices \mathbf{f}^e for all elements (determined for a beam clamped at the first node and loaded with unit loads at second node) [2-6] and \mathbf{f}_R as flexibility matrix for the supports. For rigid supports, $\mathbf{f}_R = \mathbf{0}$. Now. Eqs. (9) and (11) can be combined to obtain

$$\mathbf{F}_0 \mathbf{X} + \mathbf{q}_F = \mathbf{0} \quad (12)$$

the primary system flexibility matrix is $\mathbf{F}_0 = \mathbf{b}_X^T \mathbf{F} \mathbf{b}_X$ and the displacement vector of the primary system due to given load is $\mathbf{q}_F = \mathbf{b}_X^T \mathbf{F} \mathbf{b}_0 (\mathbf{Q}_F + \mathbf{Q}_{Fekv})$. Finally, redundants are calculated as

$$\mathbf{X} = -\mathbf{F}_0^{-1} \mathbf{q}_F \quad (13)$$

With this solution and using adopted numeration of the forces, the vector $\mathbf{Q} = [\mathbf{Q}_0^T \quad \mathbf{X}^T]^T$ can be back substituted as vector $[\mathbf{p}_{Bt}^T \quad \mathbf{p}_R^T]^T$. Internal forces at

element second node B are calculated as $\mathbf{p}_B = \mathbf{p}_{Bf} - \mathbf{p}_{B,ekv}$, while reaction at the supports are $\mathbf{R} = -\mathbf{p}_R$. For rigid supports, displacements of the structural nodes are

$$\mathbf{Z} = \mathbf{b}_0^T \mathbf{FQ}. \quad (14)$$

Regardless of the method used to obtain the solutions for the nodal displacements and forces, it is easy to determine displacements and internal forces at any section along elements.

So far, the developed in-house script includes the possibility to analyze problems with linear distributed loads acting on elements, the influence of the shear (using Timoshenko beam) is also incorporated and different types of the structural internal releases using combined node approach [4] can be analyzed. Due to easier portability, the concept of splitting the code into "functions" is not used and previously described methods are implemented into one script. Input data is given at the beginning of the script. So, the analysis of the new problem needs user intervention (i.e. script changes) to that part, only. As in any other FEM code, the following data have to be supplied: analysis method used, global node coordinates, material data, cross section geometrical properties, element data, concentrated and distributed loads, boundary conditions and internal hinges or similar internal releases. After that, the input data is prepared for further analysis. Then, depending on the chosen method (force or displacement), the code is separated into two independent branches for the processing stage. Finally, with the obtained results, the code is again merged into one flow dedicated to the post-processing features. Also, the script is written by functional parts in order to clarify and connect every step of the numerical implementation of the displacement and force method with its analytical procedures. In that way, it is very easy to adapt the existing script into MATLAB function that will be suitable for any additional and more complex analysis like various optimization problems.

One of the main benefits of the use of the platforms like MATLAB and OCTAVE is its enormous capabilities for the visualization of the solutions. The large part of the developed script is actually related to the preparation of the previously obtained solutions for displacements and internal forces for visualization, and visualization itself. Briefly, using "plot" and "patch" commands, the figures generated by the developed script are showing original and scaled deformed structure, and distributions of the internal forces.

3. Examples

3.1. Planar frame

The first analysed example is planar frame shown in Fig. 1 with linear distributed load acting on part AC, where $F = ql$. The bending stiffnesses of the frame are shown in the same Figure. Fig.2 shows adopted global and local coordinate systems, structural loads and support reactions obtained by the analytical form of the force method as $F_{AH} = 663ql/1600$, $F_{AV} = 263ql/1600$, $M_A = 389q^2/4800$, $F_{BH} = 137ql/1600$ and $F_{BV} = 1337ql/1600$.

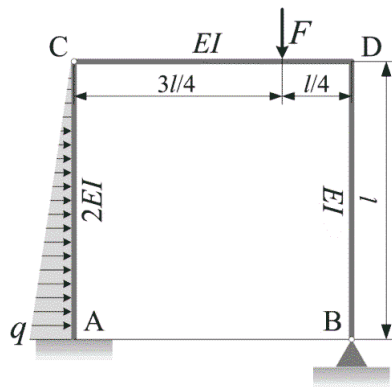


Figure 1 Planar frame

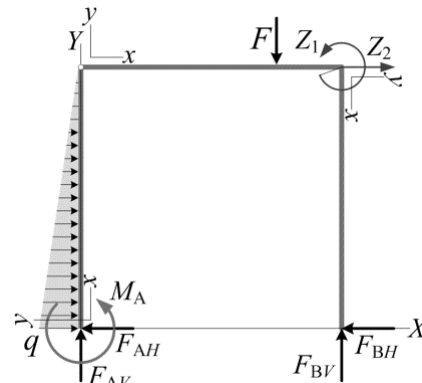


Figure 2 Loads, reactions and rigid node displacements

Also, using analytical form of the displacement method [1] with beam's axial deformations neglected, it is easy to obtain angular and linear displacement of the rigid node D, as it is shown in Fig. 2, $Z_1 = 251q^{\beta}/(9600EI)$ and $Z_2 = 23q^{\beta}/(9600EI)$.

Original and deformed structure, and internal forces distributions shown in Fig. 3., are obtained using the following data: $l = 10$ m, $E = 10^8$ kPa, $I = 10^{-5}$ m⁴, $q = 1$ kN/m, support A is fixed support with all displacements restrained, pin support B restrains horizontal and vertical displacements, and node C, as a hinge joint, permits relative rotation of the frame part CD with respect to the part AC.

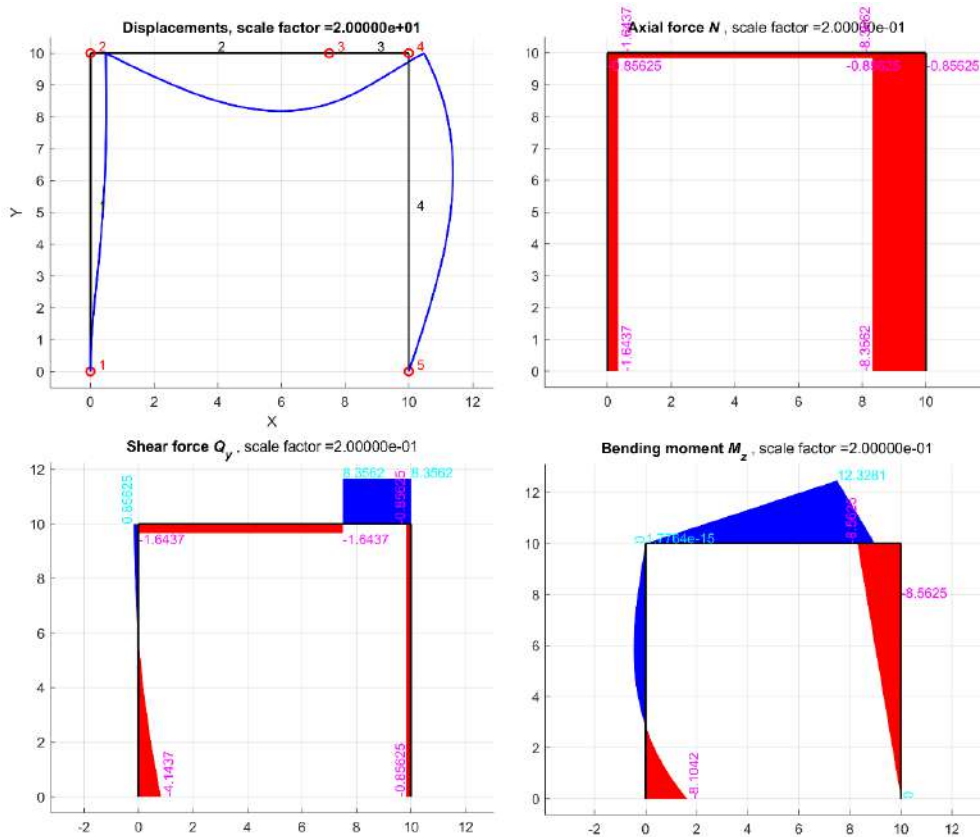


Figure 3 Displacements and internal forces distributions

As it can be seen from Fig.3, the adopted global planar coordinate system is XY system (as in Fig. 2), the nodes are shown as red circles with respective red numbers, while element numbers are colored in black. The deformed structure is colored with blue lines. Regarding internal forces distributions, negative forces are colored in red with magenta colored respective numeric values while positive forces are colored in blue with cyan colored numeric values. Numerical results obtained by the displacement and the force methods are given in Table 1.

Table 1 Numerical analysis results presented in global coordinate system XY for Example 1

Node	Reaction F_X (kN)	Reaction F_Y (kN)	Reaction M_Z (kNm)	Displacement Δ_X (m)	Displacement Δ_Y (m)	Rotation φ_Z (rad)
A	-4.1437	1.6437	8.1042	0	0	0
C (AC)	-	-	-	0.0240	0	0.0006
C (CD)	-	-	-	0.0240	0	-0.0248
D	-	-	-	0.0240	0	0.0261
B	-0.8563	8.3562	-	0	0	-0.0167

The results shown in Table 1 are rounded to 4 digits, but comparing these solutions with analytical ones, it is easy to verify the correctness of the numerical solutions, i.e. $F_{AH} = -F_{AX}$, $F_{AV} = F_{AY}$, $M_A = M_{AZ}$, $F_{BH} = -F_{BX}$, $F_{BV} = F_{BY}$, $Z_1 = \varphi_{DZ}$ and $Z_2 = \Delta_{DX}$.

3.2. Grid structure

In this example grid structure, shown in Figure 4, is analyzed taking into account all deformation modes (bending, torsion and shear).

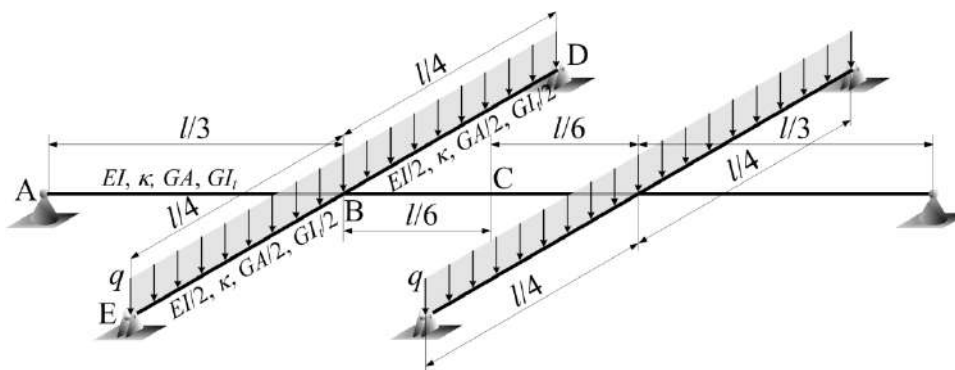


Figure 4 Grid structure

Due to symmetry, only half of the typical structure sections are denoted with capital letters A, B, C, D and E. Support A is pin support restraining only vertical displacements while supports D and E are hinge supports restraining vertical displacements and torsion. The longitudinal beam ABC has following geometric properties: $A = 1/12 \text{ m}^2$, $I = 1/40 \text{ m}^4$, $I_t = l/60$ and shear factor $\kappa = 4$. Two transversal beams are loaded with uniformly distributed load $q = 10 \text{ kN/m}$ and its geometric properties are related to the longitudinal beam properties according to the Figure 4. The material of the structure is

linear elastic material with $E = 2 \cdot 10^8 \text{ kN/m}^2$ and $\nu = 0.25$. The characteristic length dimension in Figure 4 is $l = 6 \text{ m}$. The global coordinate system XYZ and adopted local systems xyz , together with support reactions are shown in Figure 5.

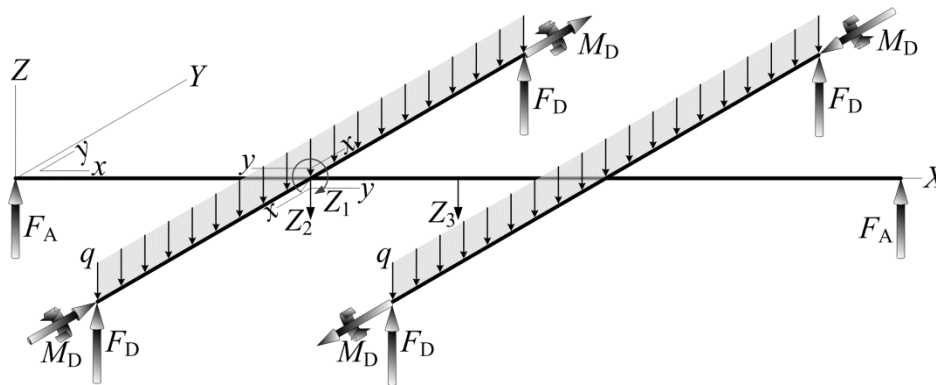


Figure 5 Loads, reactions and rigid node displacements

The angular displacement Z_1 at the section B, and linear displacements, Z_2 and Z_3 , at sections B and D respectively, are also shown in Figure 5. Due to symmetry of the structure and loads, the support reactions are equal and symmetric at the opposite structural sections. According to [1], the analytical solutions obtained by the force and displacement method are: $F_A = 64071q/792944$, $F_D = 332401q/1585888$, $Z_1 = 14175q^3/(3171776E)$, $Z_2 = 469q^4/(99118E)$ and $Z_3 = 64757q^3/(12687104E)$.

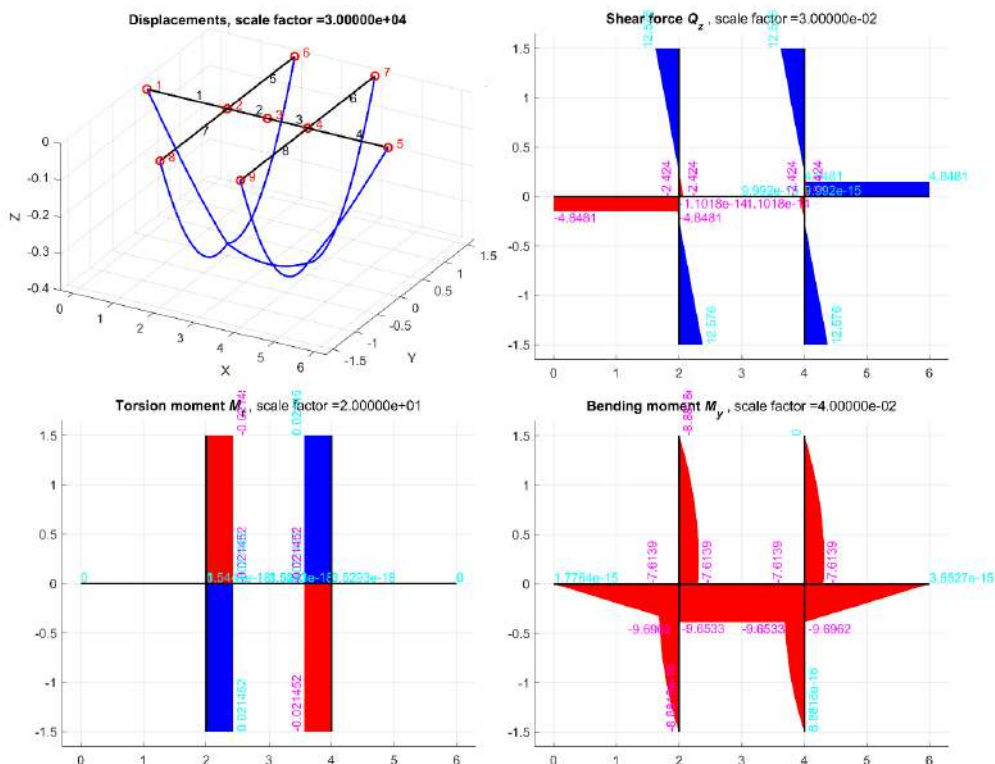


Figure 6 Displacements and internal forces distributions

Original and deformed structure, and internal forces distributions shown in Fig. 6, while numerical results obtained by the numerical methods are given in Table 2.

Table 2 Numerical analysis results presented in global coordinate system XY for Example 2

Node	Reaction F_Z (kN)	Reaction M_Y (kNm)	Displacement Δ_Z (m)	Rotation φ_Y (rad)
A	4.8481	-	0	$3.8699 \cdot 10^{-6}$
B	-	-	$-1.2265 \cdot 10^{-5}$	$1.9307 \cdot 10^{-6}$
C	-	-	$-1.3230 \cdot 10^{-5}$	0
D	12.5760	-0.02145	0	0
E	12.5760	-0.02145	0	0

Once again, comparing these solutions with analytical ones, it is easy to verify the correctness of the numerical solutions, i.e. $F_A = F_{AZ}$, $F_D = F_{DZ}$, $M_D = M_{DY}$, $Z_1 = \varphi_{BY}$, $Z_2 = -\Delta_{BZ}$ and $Z_3 = -\Delta_{CZ}$.

4. Conclusion

MATLAB script, intended for the use in the structural analysis based on matrix displacement and force method, is presented in this paper. The script with the size of 48 kB and cca 1000 lines of code (including comments) is capable to: analyse all types of beam structures (from planar truss to space frame); perform analysis with or without shear effects taken into account; analyse problems with constant and linearly distributed loads except torsional and distributed couples; to analyse structures with any type of internal release; to visualise obtained solutions generating figure with undeformed and deformed structure shown, and figures showing respective distributions of the internal forces. The only one file possessing all these features is easy portable making it suitable for teaching purposes in the field of mechanics of materials and numerical analysis. Experienced user can use this script to verify analytical solutions obtained by the force method by appropriate interventions in jordanian elimination technique. The input data for large scale problems can be defined in separated text file thus causing slight modifications of the original script. Also, the script can easily be modified for any additional purposes such as structural optimization of the beam structures using Optimization or any other MATLAB toolbox.

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FMS: FLUID METERING SYSTEM BASED ON ESP PLATFORM

Petar Zovko

University Department of Professional Studies, University of Split, Croatia
pz47985@oss.unist.hr

Luka Tomasović

University Department of Professional Studies, University of Split, Croatia
ltomasov@oss.unist.hr

Tonko Kovačević

University Department of Professional Studies, University of Split, Croatia
tkovacev@oss.unist.hr

Abstract. Solving real-world problems is a very important form of teaching applied at the University Department of Professional Studies, University of Split. The aim of this paper is to present this approach to teaching through the example of a student project implementation at the Department of Electrical Engineering. The student's task was to design and implement a system for measuring liquid in the process of filling cans with drinks using problem analysis and the knowledge acquired during the study. This paper presents the project realised in four phases. The first phase included the design and production of the printed circuit board and the realization of the electronic circuit. The Autodesk EAGLE CAD application for education was used to design the printed circuit board. During the educational process in the electronics laboratory at the Department of Electrical Engineering the LPKF ProtoMat E44 device is used for production of printed circuit boards. The realization of the electronic circuit was followed by the development of a software solution in the second phase of the project based on the open source research platform ESP. The development of a digital filter to eliminate interference from the system took place through the third phase. The fourth phase of the project included the integration of the entire system, functionality testing, the results analysis and presentation.

Key words: *printed circuit board, electronic circuit, ESP platform*

1. Introduction

Modern social environment as well as the vision of Industry 5.0, which aims to strengthen efficiency and productivity along with the role and contribution of industry to society, imposes the need for constant adaptation and improvement of educational processes [1]. The European Commission's document on achieving the European Education Area by 2025 states the need for flexible and innovative approaches to learning [2]. This means applying appropriate methods, as well as taking advantage of the opportunities and benefits of information and communication technologies (ICT) and other new technologies in terms of enriching teaching and improving learning experiences.

One of the preferred approaches of modern teaching is that learning through practice results in a high average retention rate according to the learning pyramid shown in Figure 1 [3]. This approach is recognized at the University Department of Professional

Studies (SOSS), University of Split, so solving real-world problems is a very important form of teaching applied.

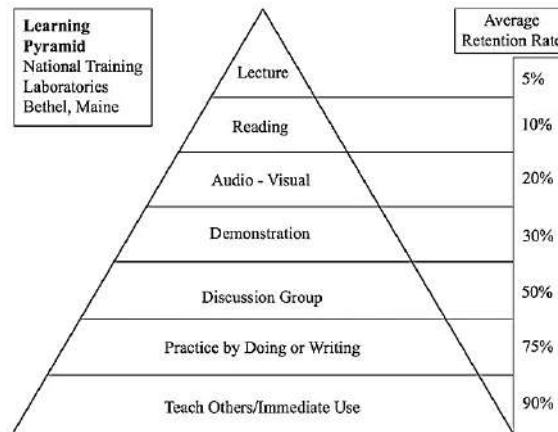


Figure 1 The learning pyramid (adapted from National Training Laboratories, Bethel, Maine [3])

Students acquire practical knowledge through laboratory exercises, team projects and professional practice, which are integral parts of the educational process. In addition, students are involved in various projects organized at the University of Split, as well as under the auspices of regional and local companies thus motivated to publish professional papers with their mentors. Examples of such projects and papers are: (i) World without boundaries [4], (ii) Production of solar elevator [5], and (iii) Access to physical objects via mobile networks [6].

The aim of this paper is to present this approach to teaching through the example of a student project implementation at the Department of Electrical Engineering. The student's task was to design and implement a system for measuring liquid in the process of filling cans with drinks using problem analysis and the knowledge acquired during the study.

This paper is organized as follows: the system design, production of the printed circuit board and the realization of the electronic circuit are given in Chapter 2 of the paper. The software solution is presented in Chapter 3. The development of a digital filter to eliminate interference from the system is described in Chapter 4. The integration of the entire system, functionality testing, the results analysis and presentation are given in Chapter 5, while the conclusions are presented in Chapter 6.

2. System Design

Figure 2 on the left shows the can filling system with liquid. Above the can there is a tube which goes down into the can and is connected to a solenoid valve that controls the liquid flow. The can bottom is placed on the load cell to measure the mass. When the solenoid valve is switched on and off, vibrations are generated and transmitted to the whole system. The complete system consists of two filling heads and four solenoid valves, two for liquid and two for gas. The mass sensor cell and the valves form a feedback system. The mass measurement starts when the fluid valve is switched on. The control unit shown in Figure 2 on the right constantly reads the measured values

and compares them to the programmed target value. Filling stops when the target value is reached.



Figure 2 Can filling system

2.1. Functional requirements

In the existing system, there is a problem of overfilling cans from 5% to 10%, which is an exceptional loss on the amount of filled cans. The problem occurs due to mechanical vibrations in the system during charging. When the electromechanical fluid and gas valves are opened and closed, the housing starts to vibrate. These vibrations are transmitted to the system what significantly affects the reliability of the measurements. The goal of this project is to redesign the control device so that the problem of overfilling cans is reduced to less than 1%.

Economic criteria require an equal balance between the price and quality, with the emphasis on quality and reliability, as well as adaptation to mass production. Design criteria are set by analyzing the requirements of the system and its functionalities including mechanical characteristics. The current shortage of electronic components worldwide due to the Coronavirus disease (COVID-19) has also been considered in the design of the system.

The requirement placed on the system is that the electronic board must not physically exceed the dimensions of 49 mm in the width and 49 mm in length with the possibility of operating two charging heads at the same time. The ESP32-WROOM-32E microcontroller was chosen as the control unit due to its availability and extremely powerful performance. Also, this microcontroller uses a real-time operating system which greatly facilitates the parallel processing and control of two independent charging heads.

To measure the liquid level in the can filling process, the mass sensor shown in Figure 3 was selected. This sensor uses four strain gauges connected in the Wheatstone bridge. The HX711 integrated circuit will be used for data acquisition.

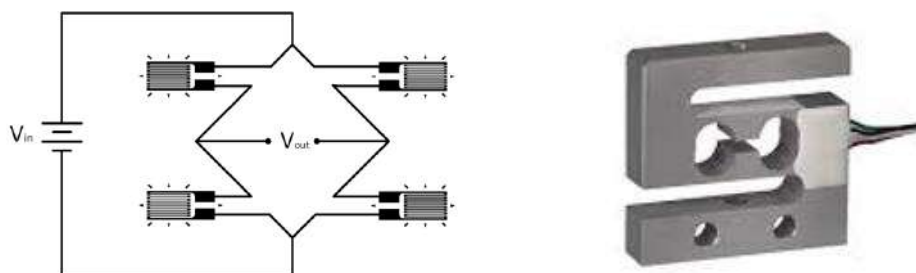


Figure 3 Strain gauge in the Wheatstone bridge and load cell

2.2. Electronic circuit design

The electronic circuit design was made in Autodesk EAGLE which is an integral part of Autodesk Fusion 360 [7]. This software package was chosen because all the steps of the production process can be done in it.

The electronic circuit board consists of two modules. The first module is the control panel with ESP32 microcontroller shown in Figure 4 [8]. The basic features of ESP32 microcontroller are: 32-bit dual-core microprocessor running at the frequency clock of 240 MHz, 320kB of integrated SRAM memory, 4MB of external flash memory for storage and a total of 40 inputs / outputs for general usage. To program ESP32 platforms and communicate with a personal computer it is necessary to use the USB/UART converter FTDI FT232 [9]. It is, also, necessary to set the GPIO0 and EN pins to the high level using two pull up resistors to operate the microcontroller. To ensure a more stable power supply and filter out possible noise from the source, three parallel capacitors were added, located as close as possible to the module.

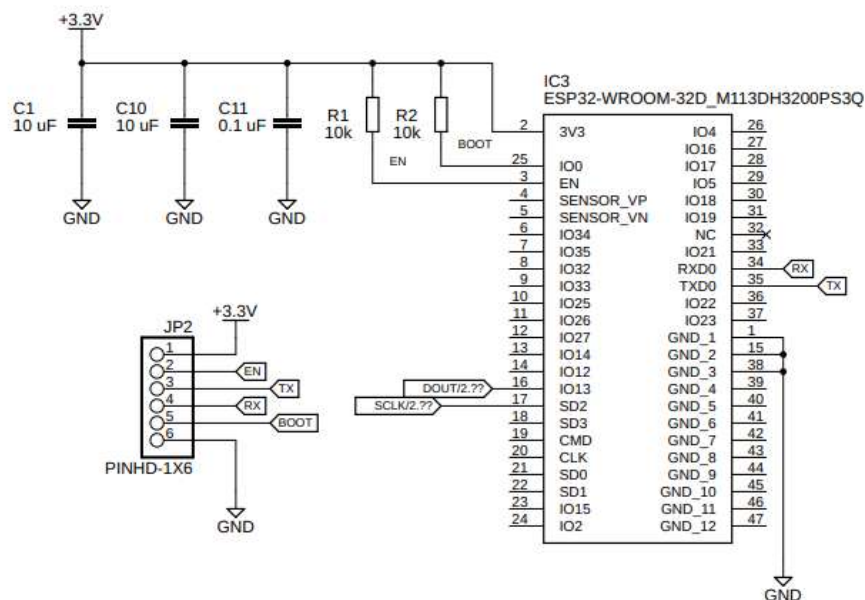


Figure 4 ESP 32 schematic

The second module was built around the HX711 chip [10], and can be divided into two basic parts, the power supply and the filter. Since this A/D converter is intended for measuring extremely low voltages, it is necessary to supply it with the most stable source. It already contains some hardware to eliminate power noise, but for additional stabilization adding external components is recommended. Two capacitors are connected in parallel with the power supply of the converter, one of 10 μ F to ensure a stable power supply and one of 0.1 μ F to eliminate high-frequency noise. A PNP transistor with two additional capacitors is used to regulate and stabilize the sensor power supply. An additional filter at the sensor output minimizes the impact of thermal noise and filters the noise transmitted through the system.

The HX711 chip can perform sampling at frequencies of 10 or 80 Hz. By setting the RATE pin to a high level the integrated circuit is placed in the sampling configuration at 80 Hz. As the weight sensor at its output gives an extremely small potential difference, it is necessary to amplify this signal in order to be able to perform the conversion. The HX711 has an integrated amplifier that has a variable gain of 64 or 128 times. The gain is selected by sending a certain number of CLK pulses after reading the value that is currently output. The 24-bit information is obtained as a double complement so it needs to be interpreted correctly.

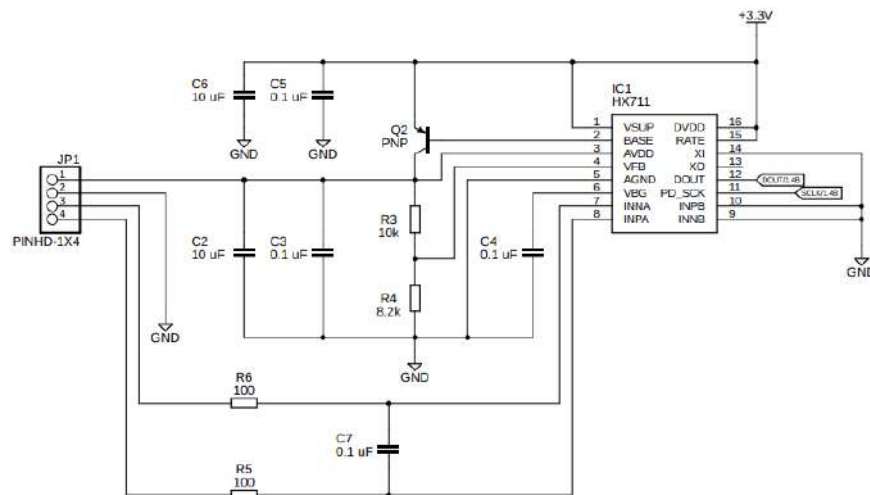


Figure 5 HX711 schematics

2.3. Printed circuit board

The designed circuit in the Autodesk EAGLE application is shown in Figure 6 and was exported to the Gerber file which in ASCII format that contains information on each physical board layer. The resulting Gerber file was imported into the LDKF CircuitPro software.

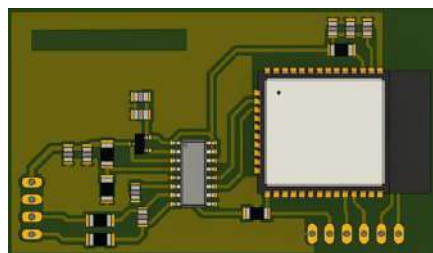


Figure 6 Designed circuit board

LPKF CircuitPro software drives LPKF Protomat E44 which is an In-House Rapid PCB Prototyping machine [11]. The layers required for production are assigned to the production stages, and the program generates the milling tool path in the individual production stages. The manufactured printed circuit board is shown on the left of Figure 7, while the board with soldered components of the electronic circuit is shown on the right of Figure 7.

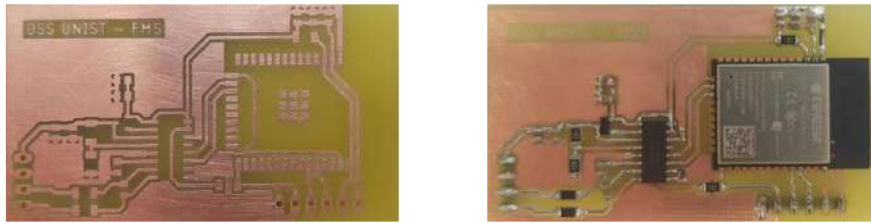


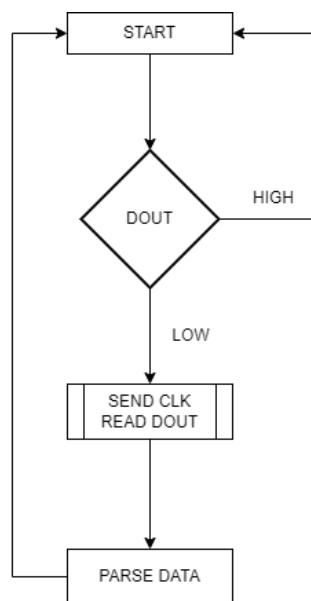
Figure 7 The manufactured printed circuit board

3. Software solution

The developed software consists of two modules. The first software module runs on an ESP32 microcontroller and is written in the C programming language. The second module represents the implementation of the digital filter.

3.1. Software module for data acquisition

This software module runs on an ESP32 microcontroller on which a FreeRTOS operating system is installed to perform multiple tasks in real time [12]. This module consists of the driver for the HX711 A/D converter with the block diagram shown in Figure 8 and the source code shown in Code 1. A two-line serial interface is used to communicate between the A/D converter and the ESP32 microcontroller. The first line is used for synchronization, clock pulses (CLK), while the second line is used for sending data (DOUT). The ESP32 microcontroller has two independent processor cores and the driver is assigned a separate thread to read data without interruption.



Code 1: HX711 driver

```

// driver code
while(digitalRead(HX_DATA))
    TaskDelay(10);
portENTER_CRITICAL(&mux);
for(uint8_t i = 0; i < 24; i++)
{
    digitalWrite(HX_CLK, true);
    ets_delay_us(CLK_HIGH);
    tmp = tmp << 1;
    if(digitalRead(HX_DATA))
        tmp++;
    digitalWrite(HX_CLK, false);
    ets_delay_us(CLK_HIGH);
}
for(uint8_t i = 0; i < GAIN; i++)
{
    digitalWrite(HX_CLK, true);
    ets_delay_us(CLK_HIGH);
    digitalWrite(HX_CLK, false);
    ets_delay_us(CLK_HIGH);
}
portEXIT_CRITICAL(&mux);
  
```

Figure 8 Block diagram and driver source code

The process of data transfer synchronization is shown in the Figure 9. After sending 24 consecutive CLK pulses (lower signal in the figure), the 24 bit sensor value is read.

These CLK pulses should not last longer than 50 microseconds so that the A/D converter does not go into sleep mode. One additional pulse is sent for internal gain selection. In our case, the gain value of 128 is used. The additional pulse is sent after every reading.

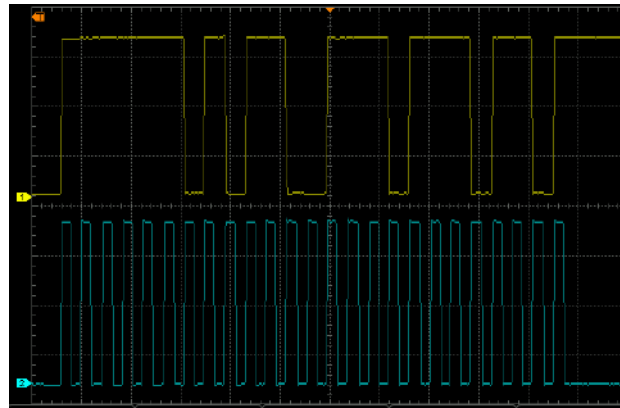


Figure 9 Recorded data

Figure 10 shows a block diagram of a program for sending data to a personal computer. A fixed time frame for data collection is used to more easily isolate the required case for analysis. After the time period of the fixed frame has expired, the microcontroller restarts and the whole cycle is repeated again.

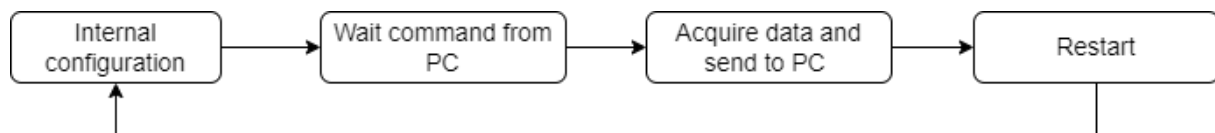


Figure 10 Communication block diagram

3.2. Digital filter function

In the program code bellow, the first-order Infinite Impulse Response (IIR) filter is implemented, which remembers only one value of the previous input and the previous output. The algorithm consists of two mathematical operations, two multiplications and two additions with decimal numbers. As the ESP32 microcontroller has floating-point unit, these mathematical operations are maximally optimized and do not represent a large CPU load. The program code is implemented as a function that receives the value directly from the driver as an argument, and returns the filtered value. This method makes it easier to change the filter parameters and the possibility of reformulating the filter equation. The IIR filter program code is shown in Code 2.

Code 2: IIR filter code

```

// IIR filter
// y[n] = b * (x[n] + x[n - 1]) + a * y[n - 1]
// x - input
// y - output
float a = 0.9687;
  
```

```
float b = 0.0157;
int32_t DoIIR(int32_t input)
{
    static float prevOut = 0;
    static float prevIn = 0;
    prevOut = (b * ((float) input + prevIn) + a * prevOut);
    prevIn = (float) input;
    return (int32_t)prevOut;
}
```

4. Filter design

Signal filtering should not introduce a large delay into a real-time system. This means that the digital filter should not perform too many mathematical operations to minimize system delay and reduce the load on the microcontroller. Therefore, an IIR filter with an algorithm given in Code 2 was designed. The realized filter is shown in Figure 11. This filter uses a feedback loop that contributes to the new value calculation. Filter order is defined by the number of feedback loops in the system. Higher-order filters have better noise elimination performance. However, every additional feedback loop introduces more delay in the system, so a compromise has to be made between noise reduction and delay.

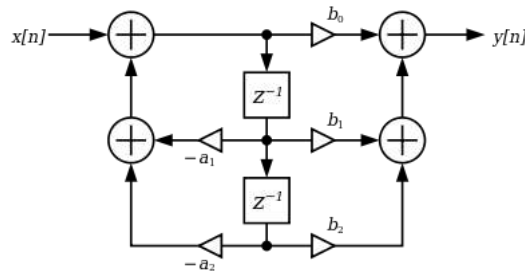


Figure 11 IIR filter structure

The IIR filter can be defined by the following formula:

$$y[n] = \frac{1}{a_o} \left(\sum_{i=0}^P b_i \cdot x[n-i] - \sum_{j=1}^Q a_j \cdot y[n-j] \right) \quad \text{Eq. 1}$$

where,

$y[n]$ – output value; $x[n]$ – input value; b_i – input values coefficients; a_i – feedback coefficients; P – filter input order; Q – feedback order.

The useful information measured by the mass sensor is contained in the DC component of the signal obtained by A/D conversion. The interference caused by vibration is located in the alternating component of the signal which adds to the DC component that represents the useful signal. The frequency of the DC component is 0 Hz, so it is not difficult to eliminate every frequency above it. Consequently, it is necessary to design a low-pass filter. For the purpose of data acquisition and analysis, as well as filter design and evaluation, the MATLAB R2021b software package is used. The MATLAB script can be divided into three basic functional units as shown in Figure 12: establishing communication, data acquisition, and filter calculation. After

successfully initializing serial communication, the ESP 32 microcontroller begins measuring and sending data to a personal computer. The collected data is displayed in the time and frequency domain to determine the vibration spectrum. With analysis of these data we estimate the passband and stopband spectrum edge frequencies for a real filter. After entering all the necessary characteristic values of the filter, a filtered signal in the time and frequency domain is obtained, which is compared to the original signal and evaluates the efficiency of the filter.



Figure 12 Data analysis and filter calculation

The Butterworth filter with the MATLAB code below (Code 3) and response shown in Figure 13 was used for this analysis.

Code 3: MATLAB code

```

%%%%%% Define global variables
portName = "COM7";
baudRate = uint32(115200);
sampleRate = double(80); %Hz
%%%%%% Initiate serial communication
ret = initCmd(portName, baudRate);
hSerial = serialport(portName, double(baudRate));
%%%%%% Define time to sample
secToSample = input(compose("Define seconds to sample 1-20 (default: " ...
    + secToSample + "): "));
%%%%%% Send settings to MCU
writeline(hSerial, compose("s"+ secToSample));
%%%%%% Prepare data buffer
dataSize = secToSample * sampleRate;
dataBuffer = double(zeros(1, dataSize));
%%%%%% Fill buffer with measurement data
for i = 1:dataSize
    dataBuffer(i) = str2double(readline(hSerial));
end
%%%%%% Plot the result
plotData(dataBuffer, sampleRate);
%%%%%% Enter passband frequency
passBandFreq = input("Enter passband frequency: ");
passBandFreq = passBandFreq / (sampleRate / 2);
%%%%%% Enter stopband frequency
stopBandFreq = input("Enter stopband frequency: ");
stopBandFreq = stopBandFreq / (sampleRate / 2);
%%%%%% Calculate filter coefficients
[order, cutoffFreq] = buttord(passBandFreq, stopBandFreq, 1, 20);
[bCoeff, aCoeff] = butter(order, cutoffFreq, "low");
filteredData = filtfilt(bCoeff, aCoeff, dataBuffer);
%%%%%% Plot result
plotData(filteredData, sampleRate);
  
```

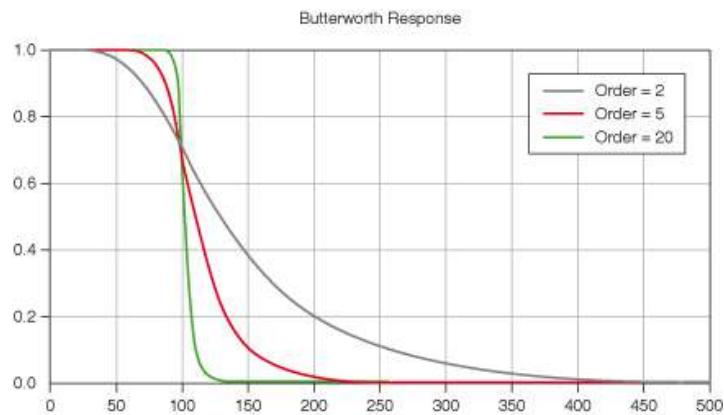


Figure 13 Butterworth filter response

5. Functionality testing

Figure 14 shows the system, which consists of the mass measurement subsystem, the electronic circuit and the interface for programming and communication with a personal computer.

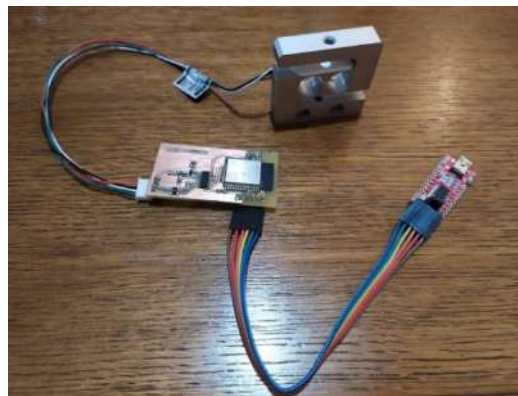


Figure 14 Realized system

For the purpose of the system testing, vibrations were simulated using a spring rod connected to the sensor to cause vibrations that need to be eliminated. The blue signal in Figure 15 represents the unfiltered sensor data. The oscillation behaves like a second-order system, which causes an overflow problem because the amplitude at the moment when the oscillation started had no stable value. The problem arises that, due to the requirement of the charging process, the initial value must be taken after opening one and closing the other solenoid valve at the time when the greatest vibration occurs. The initial value was taken at the moment when the system was unstable, the final charge value will deviate positively or negatively by the amplitude value. By filtering the signal (orange signal) the value becomes uniform, thus eliminating overflow or reducing it to acceptable values.

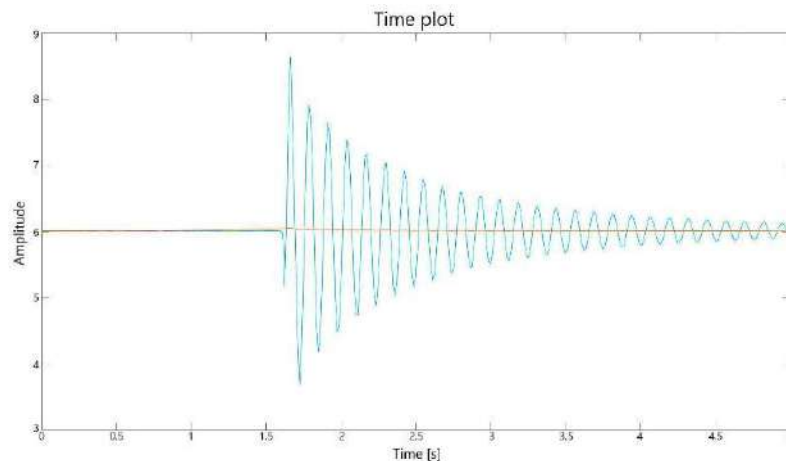


Figure 15 Raw and filtered signal

Analyzing the vibrations in the frequency spectrum shown in Figure 16, the dominant vibration frequency in the range between 5 Hz and 10 Hz was observed. The value of 4 Hz was chosen as the optimal value for the filter passband edge frequency. The blue curve represents the raw signal while the orange curve represents the filtered signal. Analysis of these data shows that vibrations were significantly eliminated from the system. In this way, the filter coefficients were determined, $a = 0.9687$ and $b = 0.0157$.

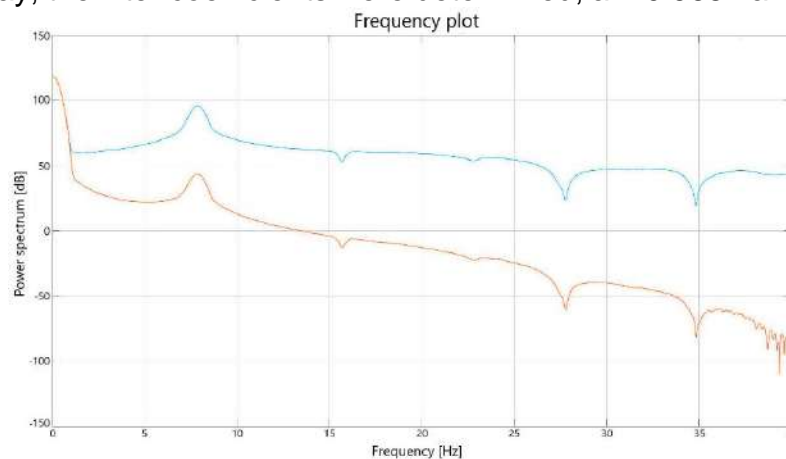


Figure 16 Frequency spectrum of raw and filtered signal

After the implementation of the filter in the system (Code 3) and the repetition of the measurements, the obtained results are shown in the time and frequency domains in Figure 17. Figure 17 shows oscillations at the beginning of the signal due to insufficient data processed by the filter. With a sufficient amount of data collected, the results become more accurate and the system stable. Testing has shown that the deviation of the filling is less than 0.5%, which satisfies the specified requirements. Analyzing the data in the frequency domain, it can be seen that the vibrations have not completely been eliminated from the system and that there are certain vibrations that have a negligible effect on the signal. The amplitude of the dominant noise frequency is reduced by more than 70 dB, which is a satisfactory result.

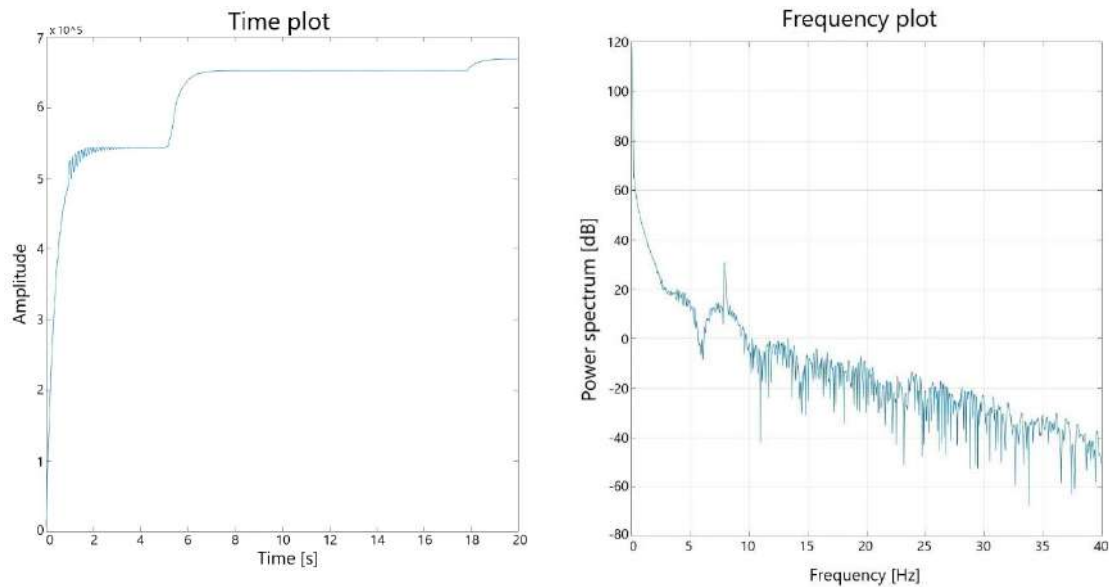


Figure 17 Time domain signal measurements on the left side and Frequency domain signal measurements on the right side

6. Conclusion

This paper presents the project that shows how students of the University Department of Professional Studies on the basis of the acquired theoretical and practical knowledge can solve real problems from practice and that they are ready for the challenges imposed on them by the labor market. Through the realization of the project, the student gained knowledge related to the analysis of real problems from practice, setting requirements for the system design, designing system hardware and software, integration of all system components and the results analysis. The implemented system shows how the requirement was achieved and the losses in the system were reduced from the initial values from 5% to 10% to less than 0.5%.

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INSTALLING AND CONFIGURING AN OPENSOURCE NETWORK MONITORING SYSTEM ON A UNIVERSITY CAMPUS NETWORK

Lada Sartori

University Department of Professional Studies, Split, Croatia
pravdica@oss.unist.hr

Nikola Grgić

University Department of Professional Studies, Split, Croatia
nikola.grgic@oss.unist.hr

Branimir Džaja

University Department of Professional Studies, Split, Croatia
brdzaja@oss.unist.hr

Abstract. The exponentially growing needs for IT services in everyday teaching and researching processes at universities in the last few decades have put a high workload on IT engineers in this sector. The large number of devices and servers in a network can't be easily supervised by one person if the representation of their states and resources is not gathered in one place, e. g. on a single web site. In this paper a large computer network at one of the faculties of the University of Split will be described and the need for having an adequate tool for monitoring and supervision of network devices and servers, as well as active services on these servers will be elaborated. There are a lot of available applications that can be used and configured, but one of the main requirements was that the chosen software is free for use in academic and educational environments and, preferably, that it is an opensource software. The paper will describe the installation and configuration processes for all kinds of different network devices and servers with various operating systems, as well as settings used to secure the equipment from potential attacks from the Internet. The final appearance of the application dashboard and the advantages obtained will be presented and discussed.

Key words: *network monitoring system, graphing monitoring, resource planning, LibreNMS*

1. Introduction

With the growing and expanding network at the University the need to have a supervision system has risen over the years. What once started as a network connecting 3-4 servers and a few dozen PCs now has more than 70 manageable network switches, about 40 servers and more than 700 computers connected. Without a centralized software that allows monitoring of all important devices the effort to track the states of all those devices would exceed the worktime of the employed IT personnel. At the moment of writing this paper 3 system engineers are covering the entire institution. Over the years several network monitoring software were used but a year ago the decision to implement a new system with a simple, clear and configurable user interface was made. The main requirements were an opensource software and free to use in academic environment. There were several options available, but the decision was made to implement LibreNMS.

Basic configuration of LibreNMS allows users to have an overview of the entire network, i. e. of all added devices, their states (up, down, warn), latest event logs, top traffic devices, as well as other configurable views.

2. Hardware requirements

According to LibreNMS documentation minimal system requirements for the initial installation would be:

- physical or virtual machine with a version of Linux operating system
- 2 core CPU (or 2vCore)
- 2 GB RAM
- 20 GB disk space

These minimal requirements satisfy the basic need for the supervision of several devices. Since the targeted network required that more than 70 devices are monitored, the requirements had to be increased.

The installation was performed with the following configuration:

- virtual Linux machine installed on VMware platform with Ubuntu 20.04.1 LTS operating system
- 4 virtual CPUs
- 8 GB RAM
- 160 GB disk space

Data accumulated over the period of one year filled 25 GB of disk space (including the operating system itself as well as all the installed packages).

3. Installation procedure

First part of the installation consists of the installation of the operating system. On the official web site of LibreNMS suggested distributions are Ubuntu, CentOS and Debian, but the software can be installed on all other distributions as well. In the given case, the latest version available at the moment of the installation, Ubuntu Server 20.04.1 LTS (long term support) without desktop environment, has been chosen. In the meantime, during the last year, it was upgraded to the version 20.04.4 LTS.

The main required packages needed for the installation of LibreNMS are web server, SQL server, PHP, Python and SNMP server.

Although LibreNMS can work on Apache web server, Nginx is recommended by the developers, so it was chosen.

Minimum PHP version LibreNMS supports is 7.4, so the installed version is 7.4.3.

The choice of SQL server might be between MySQL and MariaDB. The main advantages of MariaDB are: open-source software, operates under GPL, BSD, or LGPL licenses, supports a popular and standard querying language and supports PHP. All these characteristics made MariaDB the preferred choice.

After the initial installation of the operating system, all packages have to be updated. The command for updating the system must be run either by the root user or using `sudo` command.

```
apt update
```

```
apt upgrade
```

The documentation suggests installing package software-properties-common which allows easier management of the independent software vendor software sources. Without this package adding additional repositories should be done manually.

```
apt install software-properties-common
add-apt-repository universe
apt update
```

Now, in one line all the necessary packages can be installed.

```
apt install acl curl composer fping git graphviz imagemagick
mariadb-client mariadb-server mtr-tiny nginx-full nmap php7.4-
cli php7.4-curl php7.4-fpm php7.4-gd php7.4-gmp php7.4-json
php7.4-mbstring php7.4-mysql php7.4-snmp php7.4-xml php7.4-zip
rrdtool snmp snmpd whois unzip python3-pymysql python3-dotenv
python3-redis python3-setuptools python3-systemd python3-pip
```

3.1. Installing LibreNMS

After the installation of packages is successful librenms user should be added to the system and the directory in which LibreNMS will be installed is defined as home directory for the librenms user.

```
useradd librenms -d /opt/librenms -M -r -s "$(which bash) "
```

When the environment is prepared, LibreNMS can be installed and all necessary permissions set:

```
cd /opt
git clone https://github.com/librenms/librenms.git
chown -R librenms:librenms /opt/librenms
chmod 771 /opt/librenms
setfacl -d -m g::rwx /opt/librenms/rrd /opt/librenms/logs
/opt/librenms/bootstrap/cache/ /opt/librenms/storage/
setfacl -R -m g::rwx /opt/librenms/rrd /opt/librenms/logs
/opt/librenms/bootstrap/cache/ /opt/librenms/storage/
```

3.2. Configuring PHP

PHP dependencies are installed by librenms user:

```
su - librenms
./scripts/composer_wrapper.php install --no-dev
exit
```

For the database to be installed and used, time zones must be properly configured in php.ini configuration files:

```
vi /etc/php/7.4/fpm/php.ini
vi /etc/php/7.4/cli/php.ini
```

The time zone format for Croatia is Europe/Zagreb: `date.timezone = Europe/Zagreb`

If not set during the installation process, system time zone should be also set:

```
timedatectl set-timezone Europe/Zagreb
```

3.3. Configuring MariaDB

In the configuration file of MariaDB `/etc/mysql/mariadb.conf.d/50-server.cnf`, under the section `[mysqld]` two lines should be added:

```
innodb_file_per_table=1
lower_case_table_names=0
```

After the modification, service must be enabled and restarted:

```
systemctl enable mariadb
systemctl restart mariadb
```

Creating the database for LibreNMS is performed from the command line of database server. With the following command the root access to database server is obtained and `mysql>` prompt is presented:

```
mysql -u root
```

The following commands create the database, the user and grant all required privileges to the user.

```
CREATE DATABASE librenms CHARACTER SET utf8mb4 COLLATE
utf8mb4_unicode_ci;
CREATE USER 'librenms'@'localhost' IDENTIFIED BY 'password';
GRANT ALL PRIVILEGES ON librenms.* TO 'librenms'@'localhost';
FLUSH PRIVILEGES;
exit
```

It's a good practice to set a strong password since database servers are frequent targets of security attacks.

3.4. Configuring PHP-FPM

PHP-FPM (FastCGI Process Manager) is an alternative PHP FastCGI implementation used on heavy-loaded sites for speeding up PHP performance. For the configuration of PHP-FPM copying the default `www.conf` file and changing it is a suggested option:

```
cp /etc/php/7.4/fpm/pool.d/www.conf
/etc/php/7.4/fpm/pool.d/librenms.conf
```

Editing the `librenms.conf` section consists of renaming section `[www]` to `[librenms]`, changing user and group to `librenms` and the variable `listen` to `/run/php-fpm-librenms.sock`.

3.5. Configuring Web Server

The configuration of the LibreNMS web site is defined in `/etc/nginx/conf.d/librenms.conf` file. The content of the file is following:

```
server {
    listen      80;
    server_name server.domain.com;
```

```

root          /opt/librenms/html;
index         index.php;
charset utf-8;
gzip on;
gzip_types   text/css application/javascript text/javascript
application/x-javascript image/svg+xml text/plain text/xsd
text/xsl text/xml image/x-icon;
location / {
    try_files $uri $uri/ /index.php?$query_string;
}
location ~ [^/]\.php(/|$) {
    fastcgi_pass unix:/run/php-fpm-librenms.sock;
    fastcgi_split_path_info ^(.+\.(php))(/.+)$;
    include fastcgi.conf;
}
location ~ /\.(!well-known).* {
    deny all;
}
}

```

`server_name` should be replaced with the name of the server and web server must be restarted, as well as php-fpm:

```

systemctl restart nginx
systemctl restart php7.4-fpm

```

3.6. Configuring snmpd

SNMP server has already been installed along with all other packages required on the system. In the configuration file `/etc/snmp/snmpd.conf` community string is defined. Community string is an authentication method for the server to gain access to client's data. If the community string does not match, client will refuse the connection and sending data. After setting the string, the enabling and restarting snmpd is required:

```

systemctl enable snmpd
systemctl restart snmpd

```

3.7. Defining cron jobs

LibreNMS is gathering data from clients on regular basis. For the time interval for polling data to be defined cron service is used. Cron daemon performs tasks at a certain time or interval. The file with the instructions for the cron daemon is `crontab`. A pre-prepared `crontab` file just needs to be copied in the `cron.d` configuration directory:

```

cp /opt/librenms/librenms.nonroot.cron /etc/cron.d/librenms

```

This cron job is polling data from clients every 5 minutes, but it can be configured for any other interval.

3.8. Web installer

The last step in the installation procedure of LibreNMS is running the web installer on the address <http://server.domain.com/install>. The installer validates installed components (LibreNMS version, DB Schema, PHP, MySQL, RRDTool and SNMP). If everything is in order, the initial dashboard can be accessed.

4. Adding devices

After the installation and configuration of LibreNMS, the devices are added through web interface. For the devices to be successfully added, SNMP protocol must be installed, configured and enabled on them. In this section the procedure for several types of devices will be described.

4.1. Configuring SNMP on network devices

The majority of devices that need to be monitored in this relatively large network are switches. The campus network is built using Cisco technology, but in a few laboratories other manufacturers are used too. There are also 54 Cisco access points connected that are managed by a virtual wireless LAN controller. Some of the switches in the network are not manageable so SNMP cannot be configured on them. The logical topology of the whole network is presented on Figure 1.

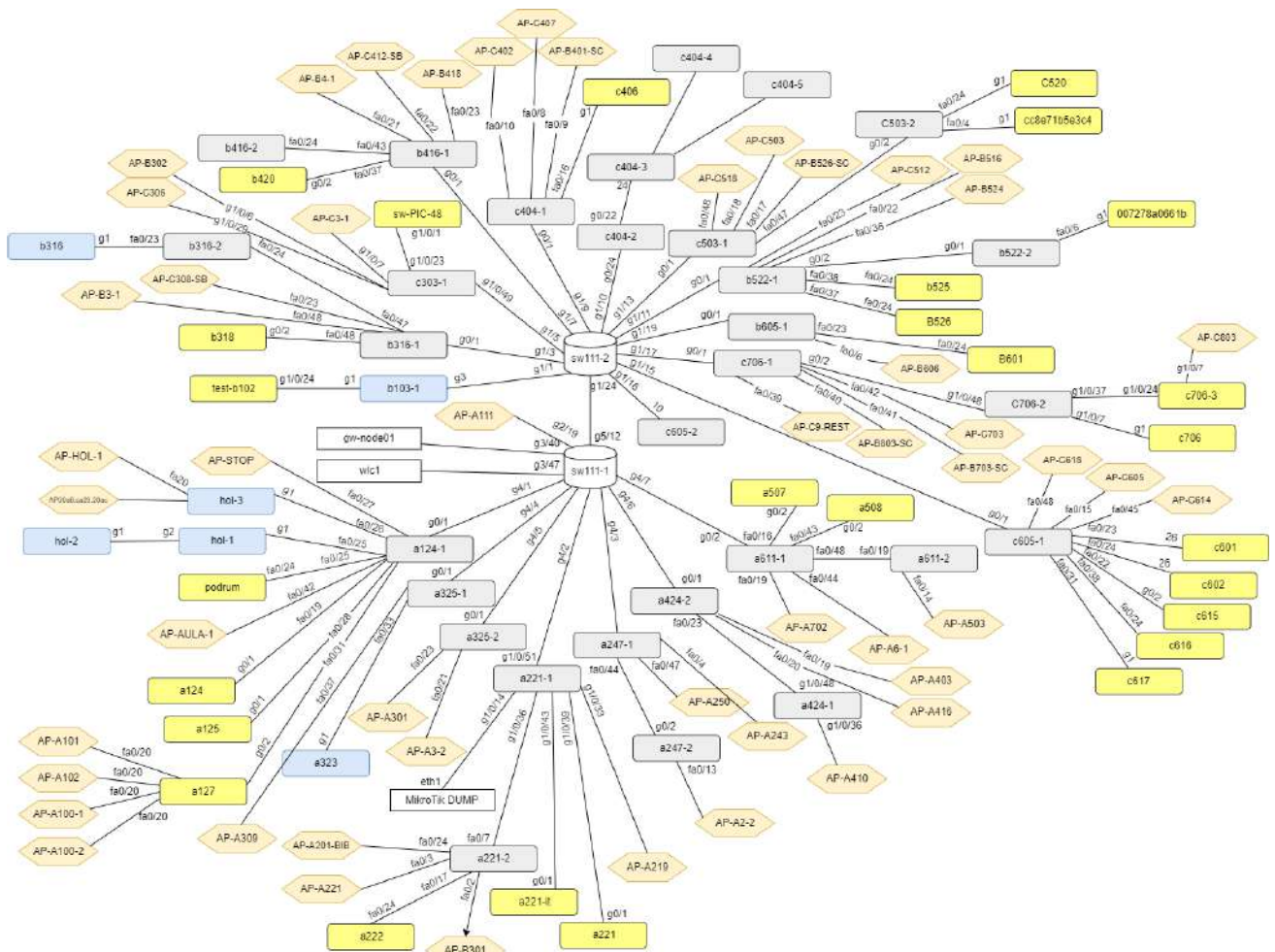


Figure 1 Campus network topology

In the centre of the Figure 1 there are two main aggregation switches, Cisco Catalyst 4500 (WS-C4506-E) and Catalyst 6506 (WS-C6506-E). Gray rectangles represent access switches that connect computers, access points and laboratory switches. Yellow and blue rectangles are laboratory switches, orange hexagons are access points while white rectangles are special types of network devices: virtual wireless LAN controller and firewall. The numbers on links connecting devices show ports to which the devices are connected.

4.2. Configuring SNMP on Cisco devices

Configuring SNMP on Cisco devices was performed through the command line of Cisco IOS. After connecting to the device and entering enable mode (Cisco term for administrator mode), the section for configuring terminal is entered. The command that activates SNMP server and defines the community string (which should be complex enough and kept secret) is:

```
snmp-server community COMMUNITY_STRING RO
```

In this paper generic community string is set to COMMUNITY_STRING. RO option defines read-only access, i.e. data can only be read from the device.

In order to secure the switch, the access only to LibreNMS server can be configured by defining its IP address (in this paper the IP address is represented by A.B.C.D):

```
snmp-server host <A.B.C.D> COMmuniTy_STRing
```

If a switch can be publicly accessed, it is very important to restrict SNMP access to only trusted devices.

Another way of securing the access to a switch through SMPT is by defining access list (ACL) and applying it to snmp-server command.

If needed, the switch can also send information to if server if defined events occur. This can be achieved by configuring traps. Some of the traps that can be enabled are: authentication, coldstart, warmstart, linkdown, linkup, config, copy-config, vtp, vlancreate, vlandelete, envmon, fan, shutdown, supply, temperature, status. After enabling some or all of these traps, if any change in these parameters occur, the switch will report it to the server. An example of activating some of the traps is using the following command:

```
snmp-server enable traps snmp authentication warmstart linkdown linkup coldstart
```

4.3. Configuring SNMP on HP devices

Configuring SNMP on HP devices can also be done from the command line. Activating the SNMP server is done using the command that at the same time defines the community string:

```
snmp-server community "COMmuniTy_STRing"
```

The command `ip authorized-managers A.B.C.D 255.255.255.255 access manager` defines IP address of SNMP server. Subnet mask that follows the IP address can define not only one IP but also a range of addresses that can access the switch.

4.3.1. Configuring SNMP on Dell devices

Configuring SNMP on Dell devices is done in a very similar way to the Cisco devices. The command for enabling SNMP can also define access to the switch:

```
snmp-server host A.B.C.D COMmuniTy_STRing
```

4.4. Configuring SNMP on servers

For now, 16 servers are added to LibreNMS management. They mostly have a version of Linux Ubuntu operating system, but there are few Linux Debian, Linux CentOS and Windows servers.

4.4.1. Installing and configuring SNMP on Linux

Installation of SNMP in Linux consists of adding the `snmpd` package. On Debian based Linux distributions `apt` utility is usually used. Along with `snmpd`, `snmp` and `libsnmp-dev` packages are needed. The command to install these packages is:

```
apt install snmpd snmp libsnmp-dev
```

In `snmpd` configuration file `/etc/snmp/snmpd.conf` a few lines must be added. Line:

```
agentAddress udp:161,udp6:[::1]:161
```

defines that the snmpd will listen on port UDP 161. The second line determines community string and the IP address of server which is allowed to gather data:

```
rocommunity COMMUNITY_STRING A.B.C.D
```

After the snmpd is configured, service has to be restarted:

```
systemctl restart snmpd
```

In RedHat distributions yum utility is used to install packages

```
yum install snmpd
```

while the changes in the configuration file and restart procedure are the same.

The easiest way to ensure the security of SNMP is to add firewall rules that allow communication on port 161 only for the desired server and block all other IP addresses.

On Linux computers iptables firewall is usually used. The lines that should be added are:

```
iptables -A INPUT -p udp -s A.B.C.D -m udp --dport 161 -j ACCEPT
```

```
iptables -A INPUT -p udp -m udp --dport 161 -j DROP
```

4.4.2. Installing and configuring SNMP on Windows Server

On Windows Server SNMP is installed by selecting SNMP from the list of Windows features (Server Manager -> Dashboard -> Add Roles and Features Wizard). After the installation, SNMP service must be configured by running services.msc as Administrator. From the list of services, SNMP is selected and the startup type is set on Automatic. By selecting the tab Security on SNMP Service Properties window community string can be added and the rights should be set to READ ONLY. In the same tab access can be defined by selecting "Accept SNMP packets from these hosts" and by adding the IP address or the name of LibreNMS server.

4.5. Adding devices through web interface

On LibreNMS web site devices are added through the menu Devices -> Add device. Parameters that need to be entered are the IP address or host name, SNMP version, port number, protocol by which it can be reached (TCP or UDP) and the community string. If LibreNMS has access to the device, the device type is automatically detected and initial data is pulled from the client.

5. Using LibreNMS

After configuring and adding all the desired devices, LibreNMS dashboard lists 78 devices. The devices are automatically divided to sections Network (containing switches, routers, firewalls), Server (containing Linux and Windows servers) and Wireless (containing wireless LAN controller, since access points in the network are configured by the controller and cannot be configured individually). Section Network has 61 entries, while section Server has 16 entries.

Dashboard page is configurable and user can choose the blocks that are visible, as well as their layout on the main page. The view of the dashboard that the administrator configured is shown on Figure 2

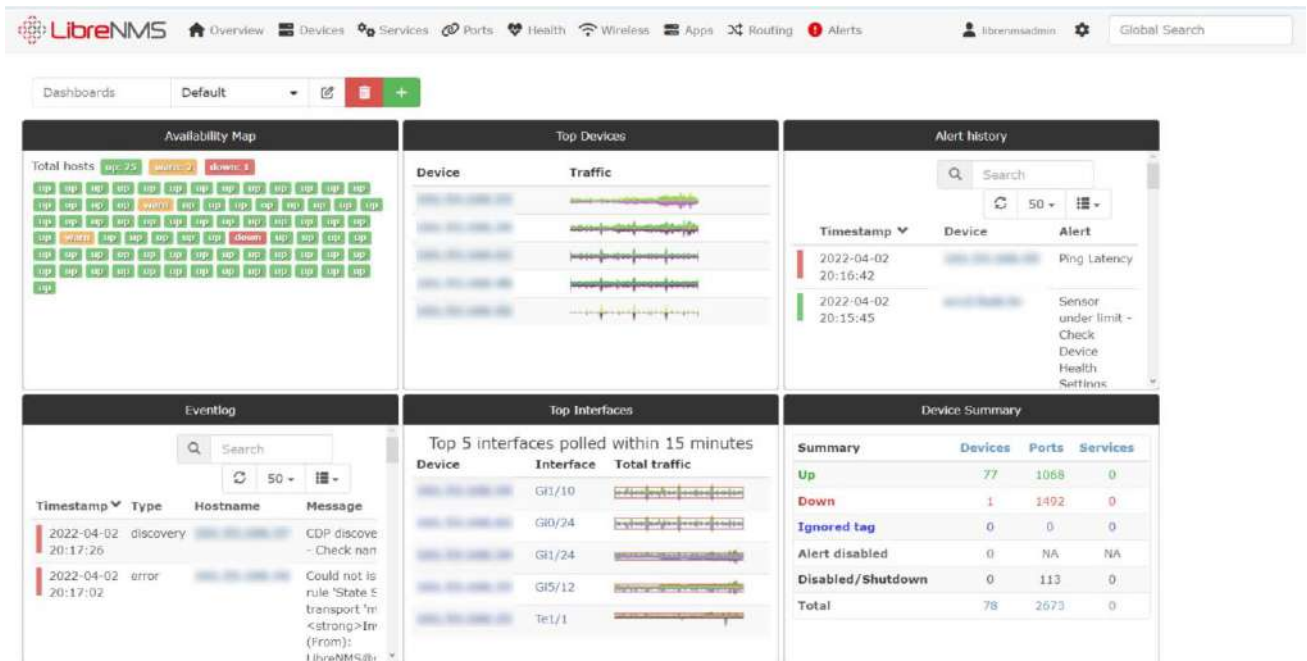


Figure 2 LibreNMS chosen dashboard layout

Sections containing IP addresses or host names are blurred in all figures to avoid public exposure of sensitive data. First block is Availability map on which the states of all devices can be easily overviewed at a glance (up – green, down – red, warn – yellow). The block Eventlog shows the last events, while the block Alert shows last alerts. Blocks Top Devices and Top Interfaces show devices and interfaces with the most traffic during the last 24 hours and 15 minutes, respectively. Device Summary block gives a summary of devices, ports and services status in a given moment.

Through the menu item Devices the list of all devices is shown, a part of the listing is shown in Figure 3.

S.	Id	M.	Vendor	Device	Metrics	Platform	Operating System	Up/Down Time	Location	Actions
	67		Cisco	SF300-24 V03	36 28	SF300-24 V03	Cisco Small Business Software 1.3.0.62, Bootldr 1.1.0.6, Firmware 1.1.0.6 (SRW224G4-K9)	1d 11h 42m 14s		[Icons]
	66		Cisco	Catalyst 2960X (WS-C2960X-48TS-L)	59 5	Catalyst 2960X (WS-C2960X-48TS-L)	Cisco IOS 15.2(2)E7 (UNIVERSALK9)	117d 6h 38m 47s		[Icons]
	65		Cisco	SF300-24 V04	35 28	SF300-24 V04	Cisco Small Business Software 1.4.2.4, Bootldr 1.3.5.06, Firmware 1.3.5.06 (SRW224G4-K9)	117d 6h 46m 9s		[Icons]
	64		Cisco	SF350-24 V01	38 28	SF350-24 V01	Cisco Small Business Software 2.4.0.94, Bootldr 1.0.0.0, Firmware 1.0.0.0 (SF350-24-K9)	117d 6h 47m 59s		[Icons]
	89		Cisco	SF300-24 V03	37 28	SF300-24 V03	Cisco Small Business Software 1.3.0.62, Bootldr 1.1.0.6, Firmware 1.1.0.6 (SRW224G4-K9)	115d 9h 55m 18s		[Icons]
	69		Dell	PowerConnect 6224	77 1	PowerConnect 6224	Dell PowerConnect 3.3.7.3 (Dell Ethernet Switch)	117d 6h 42m 32s		[Icons]
	71		Cisco	SF300-24 V03	38 28	SF300-24 V03	Cisco Small Business Software 1.3.0.62, Bootldr 1.1.0.6, Firmware 1.1.0.6 (SRW224G4-K9)	117d 6h 16m 17s		[Icons]
	72		Cisco	Catalyst 2950G (WS-C2950G-24-E1)	29 3	Catalyst 2950G (WS-C2950G-24-E1)	Cisco IOS 12.1(22)EA3 (I6Q4L2)	117d 6h 38m 24s		[Icons]
	73		Cisco	Catalyst 2950 (WS-C2950-24)	27 3	Catalyst 2950 (WS-C2950-24)	Cisco IOS 12.1(22)EA14 (I6Q4L2)	117d 6h 46m		[Icons]
	70		Dell	PowerConnect 6224	77 1	PowerConnect 6224	Dell PowerConnect 3.3.7.3 (Dell Ethernet Switch)	117d 6h 42m 13s		[Icons]
	74		Cisco	SF300-24 V03	36 28	SF300-24 V03	Cisco Small Business Software 1.3.0.62, Bootldr 1.1.0.6, Firmware 1.1.0.6 (SRW224G4-K9)	117d 6h 44m 56s		[Icons]

Figure 3 Part of the list of monitored devices

In the overview the device platform, operating system and uptime are shown.

When a device is selected information about it is presented. If the device is a switch the main information presented are traffic overview, port states, VLAN data, neighbours and STP information. If the device is a server, the graphs of system resources are the focus of the data.

One of the monitored servers is shown in Figure 4 Every section can be further expanded, e.g. the block Processors on the front page of a device overview shows processor load during the last 24 hours, but when clicked on, periods of 6, 24, 48 hours, one or two weeks, one or two months and one or two years can be selected. The same stands for the Memory block. Another piece of information is the status of storage space, divided by partitions. This information can be very useful in resource planning, since it can show the trend of resource consumption allowing an estimate when a hardware upgrade might be needed or when a new device should be acquired.

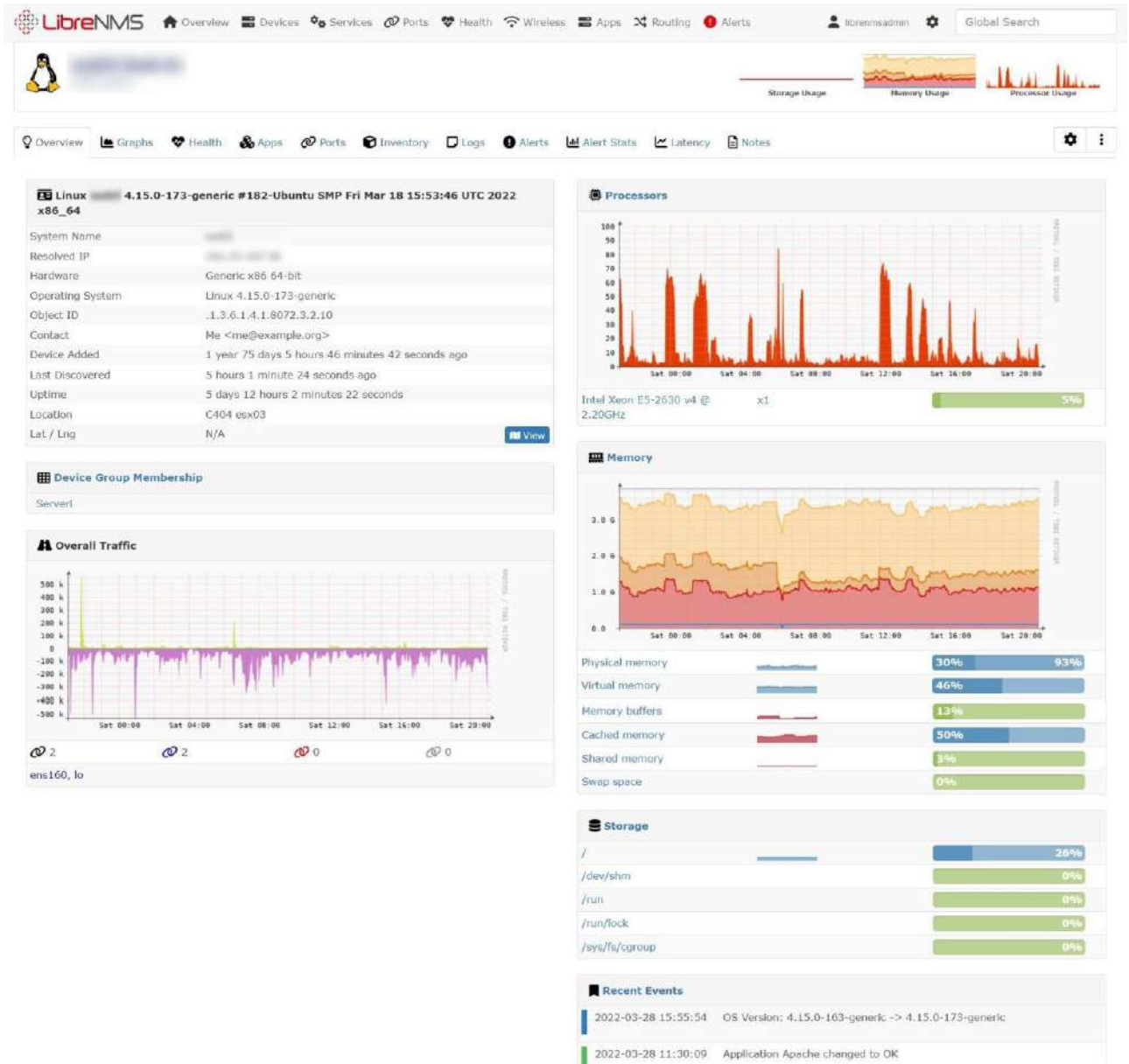


Figure 4 Overview of the data of a monitored server

These figures are just a tiny part of the data that LibreNMS can present to the user. Another feature that can be configured are Alerts. Alerts are shown in their section, but they can be configured to be e-mailed to the administrator when they occur. In order to configure e-mail alerts an e-mail server has to be defined and configured (protocol used to send an e-mail, SMTP server, SMTP port and the From: e-mail address). The level of the alerts can be set ranging from warning to critical.

6. Conclusion

Since the campus network on the University of Split has significantly grown in the last few decades having an overview of all the important devices in one place facilitates the work of system administrators. LibreNMS has a large number of very useful

features that the administrators consult on a daily bases. The features administrators use most frequently are:

- the information about states of devices (up/down), with one look on the dashboard the devices that are down are instantly spotted
- configuration of switch ports is more easily accessible through the web interface of LibreNMS than by connecting to a switch, port description is easier to examine and unused ports are easily detected
- switch ports that are under heavy traffic load can be spotted on the front page
- any type of event that can be considered suspicious is also shown on the front page
- if a server is slow, graphs can indicate the source of the potential problem (CPU, memory, disk, network traffic...)
- network neighbors show interfaces that connect the devices
- switch ports with errors are singled out

One feature that was not given much emphasis in the paper is the monitoring of the services running on servers (Apache, MySQL, DNS...). LibreNMS allows for a number of services to be monitored, but only a few services are added and monitored on the campus network. This is a segment that should be largely expanded in the future.

With all of this taken in consideration LibreNMS has shown to be a valuable tool and the use of which has yet to increase.

DESIGN AND DEVELOPMENT OF A MULTI-ENGINE UNMANNED AERIAL VEHICLE

Siniša Zorica

University of Split, University Department of Professional Studies, Split, Croatia
szorica@oss.unist.hr

Sandra Antunović Terzić

University of Split, University Department of Professional Studies, Split, Croatia
santunov@oss.unist.hr

Marinko Lipovac

University of Split, University Department of Professional Studies, Split, Croatia
lipovac@oss.unist.hr

Joško Smolčić

Craft Technical School Split, Croatia
josko1911@gmail.com

Dario Batinić

University of Split, University Department of Professional Studies, Split, Croatia
d.btnc18@gmail.com

Abstract. One example of the technological advancement is the unmanned aerial vehicle, or as we call it most commonly, the drone. A human, not from the inside, but by radio signals, controls it. Their application is relatively new and they are still in development. They have a wide application, not only for military and civilian, but also mostly for recreational purposes. For decades, they have been used for scientific research, commercial purposes and for various public safety tasks to capture endangered areas, for mapping, better communication, rescue, and research as well as traffic inspections. To build such a dynamic unmanned aerial vehicle it is necessary to attach many complex electronic devices like brushless DC motor, control board, electronic speed controller, digital servomotor, battery etc. In order to make a high quality drone, it is necessary to know its basic parts and how they work. In this paper, the design process of quadcopter unmanned aerial vehicle is presented. HGLRC F4 V6 PRO flight controller is used to control UAV. Its purpose is to stabilize the drone during flight and to do this, it takes signals from on-board gyroscopes (roll, pitch and yaw) and passes these signals to the processor. The processor processes signals according to the users designated firmware and passes the control signals to the mounted electronic speed controllers and the mixture of these signals commands the electronic speed controllers to make fine adjustments to the motors rotational speeds, which stabilizes the craft. Betaflight software is used for programming flight controller.

Key words: Drone, Unmanned Aerial Vehicle, Betaflight

1. Introduction

An unmanned or uncrewed aerial vehicle (UAV) is an aircraft without any human pilot, crew, or passengers on board. Such an aircraft is actually a flying robot that can be remotely controlled or independently flown via software-controlled routes. In the not-so-distant past, UAVs were most commonly associated with the military industry, where they initially used to train anti-aircraft forces and then as weapon platforms.

Today, we use UAVs in a wide range of roles, for search and rescue, surveillance, traffic monitoring, weather, firefighting, agriculture, delivery services or personal use. Many UAVs are available for personal use offering high-resolution videos, mainly for entertainment. Such UAVs can often weigh less than half a kilogram and up to 10 kilograms. The main advantages of unmanned aerial vehicles are that they can fly over long distances, but still these distances have their limits. Some commercial applications of drones are for monitoring buildings, agricultural activities, drug deliveries or other payloads [1]. UAVs for shipment delivery have a great tendency to grow and develop. Term drone we often use for UAV. The term drone actually means any vehicle that can function autonomously (by itself) or is unmanned. This means that drones can include any vehicle that does not have a pilot or driver but can still function well on its own. In addition, when we say “any vehicle”, we literally mean any vehicle. As such, the term drone also covers vehicles that work in the air, in water, and on land. Among hobbyists, the most popular type of UAV is the quadcopter. Quadcopter have four rotors, strategically placed in all four corners of the quadcopter to allow it to fly balanced. This paper presents the development of quadcopter intended for hobbyists.

2. Description of the quadcopter system

The quadcopter generally consists of quadcopter frame, DC motors, propellers, electronic speed controllers (ESC), inertial measurement unit (IMU) that can be integrated in flight controller, radio control unit (RC), power unit (battery), power distribution board and flight controller [2], depicted in Figure 1.

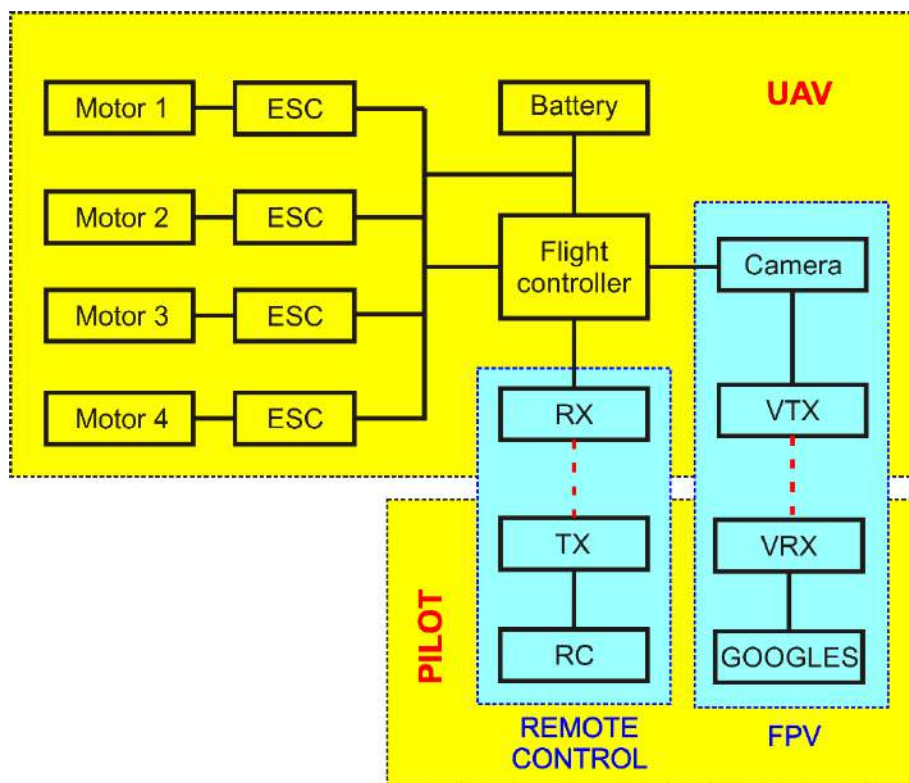


Figure 1 Quadcopter system

Designing a custom quadcopter requires forward planning on what type of quadcopter it should be. For example, a racing FPV (First Person View) drone is small, light and quite manoeuvrable, and an Aerial cinematography quadcopter is massive, heavy and steady to be able to carry different kind of cameras and take videos in stable manner.

Planning a quadcopter starts with choosing a base for all electronics - a quadcopter frame. Once decided on what frame to get, the heaviest part of a drone is chosen next – the battery, a power source of a quadcopter. As soon as approximate weight of the drone is known, by adding up frame's, battery and electronics' weights, choosing motors is the next step. Motors need to have enough thrust power to lift off the drone from the ground and steadily hover. Propellers are usually chosen depending on frame dimensions. For motors to work properly, electronic speed controllers are needed. Properly connecting all of the motors to a power source require a power distribution board. All of the remaining electronics: RC, IMU and flight controller – are usually chosen depending on personal preferences.

2.1. Quadcopter frame

Quadcopter frame is one of the most important part of quadcopter because it supports motors and other electronics and prevents them from vibrations. It is necessary to be very precise while making it. They need to be designed to be strong but also lightweight.

A frame kit ZMR250, depicted in Figure 2, is chosen for the project, and specifications are given in Table 1.



Figure 2 ZMR250 frame kit

Table 1 ZMR250 frame kit specifications

Chassis Plate Thickness	1.5mm
Arm plate thickness	3mm
Main material	carbon fibre
Diagonal size	250mm
Weight	145g (with screws)

Flight Controller Mount	30.5mm * 30.5mm
Board Camera Mount	32mm * 32mm
Motor Mount	M2 12mm – 16mm (Tiger MN1806 2300kv, RCX 1804 2400kv), M3 19mm (Tiger MT2206 2000kv, Sunnysky X2204 2300kv)

2.2. Battery

Multi-rotor aircraft use LiPo (Lithium Polymer) batteries, which consist of cells, with a nominal voltage of 3.7 V for each cell. The voltage varies from 3.0 V to 3.2 V when discharged, and 4.2 V when charged, all for just one LiPo battery cell. If battery is discharged below or charged above the permissible level, damage or inflammation may occur. These batteries are used since they provide a large amount of power due to their size and weight, and because they have a high enough voltage to power the UAV with fewer cells than some other type of rechargeable batteries. Continuous battery discharge is an important battery feature. The continuous discharge mark is C and it indicates how much capacity the battery can give during continuous discharge. For example, with a 1000mAh battery that has a value of 20C, the continuous discharge will be 20 amps. Calculation: $1000\text{mAh} \times 20\text{C} = 20000\text{mA} = 20\text{A}$. LiPo batteries have a nominal voltage of 3.7 V per cell. Cells can be connected in series to achieve higher voltage and in parallel to achieve higher power. Batteries made in this way have four-digit markings on them, such as 3S2P or 2S1P, where S denotes the number of cells connected in series, and P the number of cells connected in parallel. For this project, Dinogy Sport 3S 2200mah 30C (DS-3S2200D) battery is used, depicted in Figure 3. Battery specification are given in Table 2.



Figure 3 DS-3S2200D battery

Table 2 DS-3S2200D battery specification

Capacity	2200Mah
Cells	3S
Volts	11.1V
Continuous discharge rate	30C
Max discharge rate	60C
Dimensions	25x35x102mm
Weight	182g
Max charge rate	3C

Max charge amps	6.6A
Charge Plug	JST-XH
Discharge plug	XT60

2.3. Motors

All multirotor UAV mainly use Brushless Direct Current Motor (BLDC) motors due to their high efficiency and very small dimensions. Since the motor does not have a brushes, friction is minimized and thus energy losses. Therefore, BCDL motors have high efficiency and are suitable for use in UAV. The quadcopter, a four-engine aircraft, has two pairs of the same motors with identical specifications. In each pair, the motors are located opposite each other and are marked with CW (clockwise) and CCW (counter clockwise), depicted in Figure 4.

Engines control the movement of UAV and there are four basic ways to control and move a drone: ROLL - UAV moves left or right, PITCH - UAV moves forward or backward, YAW - UAV rotates around its axis, THROTTLE - UAV goes up or down. Horizontal movement is achieved by tilting the platform while vertical movement is achieved by changing the total engine thrust, as depicted in Figure 5.



Figure 4 Position of motors

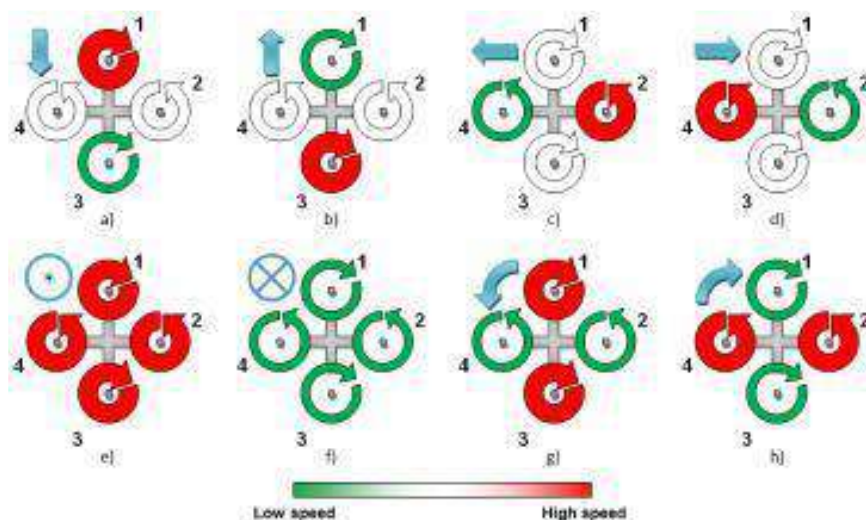


Figure 5 Motor speed for roll, pitch, yaw and throttle

There are two configurations for quadcopter design, "+" and "x", depicted in Figure 6. The "x" configuration quadcopter is considered more stable compared to the "+" configuration, which is an acrobatic type. For the quadcopter to be able to maintain forward movement by increasing the speed of the front rotors while reducing the speed of the rear rotor simultaneously, which means changing the pitch angle [2].

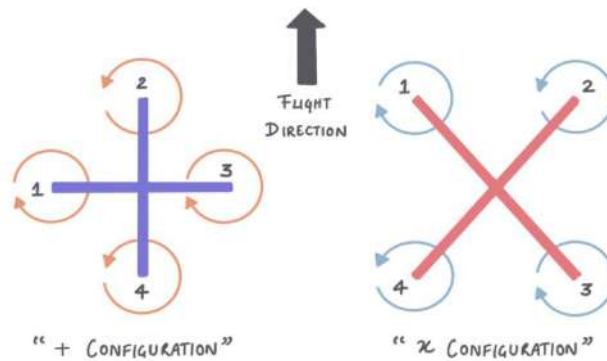


Figure 6 Types of quadcopter configuration

In this project, motors RaceStar BR2205 2300KV are used, and specifications are given in Table 3. Although it is possible to change the direction of rotation of the motor using electronic, there are CW and CCW motors that have different screw thread. In used motors, CW screw thread motor comes with red cap and CCW screw thread motor comes with black cap, as depicted in Figure 7.



Figure 7 RaceStar BR2205 2300KV

Table 3 Racerstar Racing Edition 2205 BR2205 2300KV specifications

RPM/V	2300KV
Height	31.5mm
Width	27.9mm
Shaft diameter	M5
Motor mount hole size	M3
Weight	28 grams

Voltage	2-4S
Battery	2-4S lipo battery
Max. current	27.6A
Max. power	950W
Usage	for 250 260 280 Multirotor Frame Kit

Motor outline drawing is depicted in Figure 8 and motor performance data are given in Table 4.

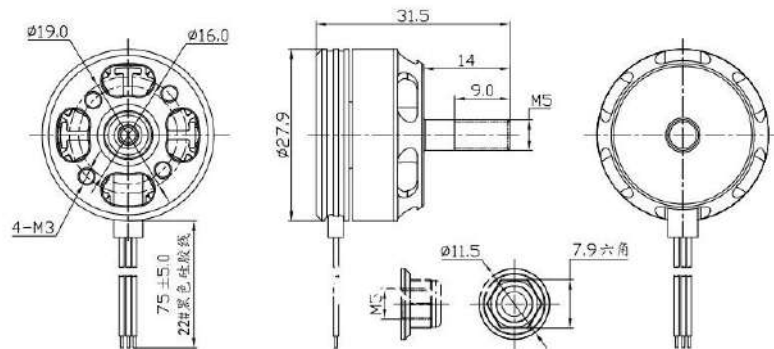


Figure 8 RaceStar BR2205 2300KV outline drawing

Table 4 Racerstar Racing Edition 2205 BR2205 2300KV performance data

MODEL	KV (RPM/V)	VOLTAGE (V)	PROP	LOAD CURRENT (A)	PULS (G)	POWER (W)	EFFICIENCY (g/W)	LIP CELL	WEIGHT (g) APPROX
BR2205	2300	11.1	5045	19.2	660	213	3.1	2-4S	28
		14.8		27.6	950	408	2.3		
	2600	11.1	4045	18.5	730	205	2.6		
		14.8		23.2	710	343	2.1		

2.4. Electronic speed controller (ESC)

ESC (electronic speed control) is an electronic circuit used to change the speed of an electric motor, and serves as a dynamic brake. It is an interface between motor and flight controller. It takes energy for motor directly from the battery, but it is controlled via a flight controller. ESC works by applying full voltage to the motor, but turning it on and off rapidly (PWM - Pulse Width Modulation). ESC provides motor soft start to reduce vibration. By varying the ratio of ON-OFF time, the speed control varies the average voltage that the motor sees. For this project, electronic speed controller HGLRC 30A is used. It supports 30A steady current, 40A peak current, size is 26mm×14.5mm and weigh 5.4g.

2.5. Propellers

The propeller is an aerodynamically shaped surface that converts the mechanical operation of the engine (rotational) into thrust and thus allows movement in the form of flight. In order to produce thrust they must have a certain angle of rotation. The angles must be opposite to each other in order for the thrust to be created in the right

direction. As the motor speed increases, the propellers create more and more thrust and give more and more lifting force. Factors such as the maximum speed and size of the propeller as well as the rotation angle of the propeller angle are interdependent. The size of the propeller must not exceed the maximum allowable size adapted for that motor, as prescribed by the manufacturer, otherwise the motor rotor as well as the entire housing and shaft will rupture. The propeller is an important component because the speed and efficiency of the UAV depends on it. In addition, the propeller is responsible for vibrations, which are important in case the UAV is used for video recording. There is a rule of three simple measurements. The first is length, usually expressed in inches. The higher the *KV* (rpm/V) of the motor, the smaller the propeller must be. Smaller propellers allow for higher speeds but reduced efficiency. The second measurement is the size of the angle. The greater curvature, greater thrust and the required engine power. The lower angle is more efficient and gives a calmer flying style. The third measurement is the diameter of the hole for the motor shaft.

In this project, three-bladed propellers Dalprop T5046C are used. Two-blade propellers produce two thrusts per turn, while three-blade propellers produce three thrusts that are slightly weaker but equal to the same amount of total thrust, with more stable, quieter and less noise production [3]. The propeller specifications are given in Table 5.

Table 5 Dalprop T5046C propeller specifications

Material	Polycarbonate
Hub Thickness	8mm
Shaft Hole	5mm
Weight	5.4g
Diameter	5"
Pitch	4.6"
Blades	3
Rotation	CW & CCW

2.6. Flight controller

Flight controller is a combination of hardware and software that helps control the UAV flight [4]. Simply put, the tasks of a flight controller are sensing, controlling and communicating. Sensors give the flight controller information about like its height, orientation, and speed. Common sensors include an Inertial Measurement Unit (IMU) for determining the angular speed and acceleration, a barometer for the height, and distance sensors for detecting obstacles. It controls the motion of the drone. The drone can rotate and accelerate by creating speed differences between each of its four motors. The flight controller uses the data gathered by the sensors to calculate the desired speed for each of the four motors. The flight controller sends this desired speed to the Electronic Speed Controllers (ESC's), which translates this desired speed into a signal that the motors can understand. Calculating the movements, fusing and filtering the sensory information and estimating the safety and durability of a flight is all done by an algorithm, a set of strict rules that every microchip on the board has to apply to. The most commonly used flight control algorithm is PID control: Proportional Integral Derivative control. A key part of a flight controller is communication. A part of the

sensor's job is to give out information that needs to be translated clearly for a pilot to read, which means efficiently. An obvious thing to communicate is its battery level, which can decide if a pilot wants to fly further or return to the charge. However, communication goes further than from flight controller to human pilot; with the entrance of auto-pilot programs in the drone industry, flight controllers need to communicate with other computer systems about its flight destination and how to get there. Communication is mostly done with Wi-Fi and radio frequencies right now, but cellular solutions are also already in use. In this project, HGLRC F4 V6 PRO Flight Controller is used, depicted in Figure 9 and Figure 10. It is based on STM32F405RGT6 CPU and MPU6000 IMU (Inertial Measurement Unit) with built-in BETAFLIGHT OSD to achieve remote control of PID parameters. It size is 44.7 x 40.5mm, weight 15.6g without antenna and antenna cable. Operating frequency is 5.8GHz, it has built-in FPV transmitter (0-600mW) and support SBUS/PPM/DSMX.

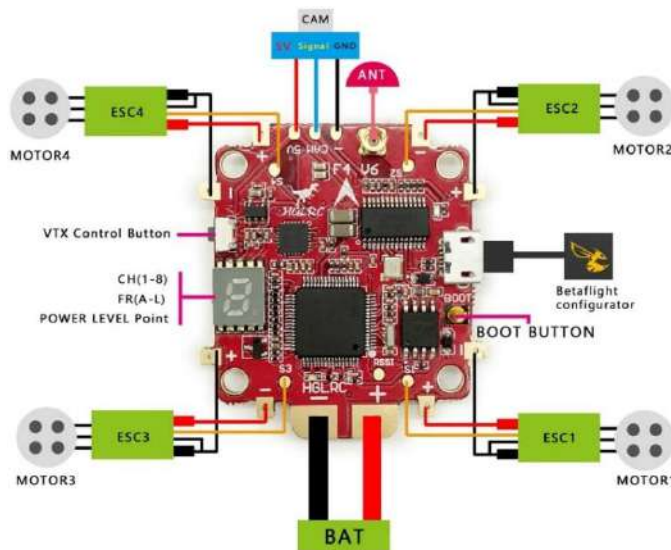


Figure 9 HGLRC F4 V6 PRO top view

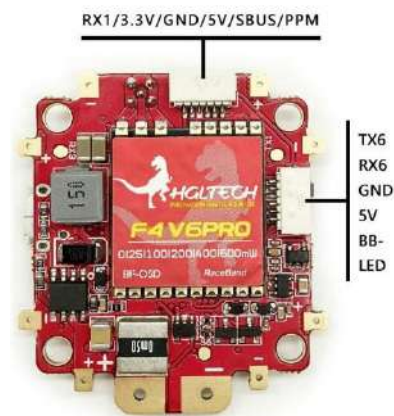


Figure 10 HGLRC F4 V6 PRO bottom view

2.7. FPV

FPV (First Person View) technology displays a video signal on the pilot's screen or more popular today on FPV goggles that evoke the feeling of flight even more. This technology is responsible for the popularization and development of UAV for hobbyists [5]. For this project, Foxeer Monster V2 1200TVL camera is mounted on UAV. It has resolution 1280x960 pixel, weight 14.6g and size 26mmx26mmx30mm. The FPV goggles are Eachine EV800 with Build in 5.8G 40CH Raceband receive. Camera is depicted in Figure 11 and tracking goggles in Figure 12.



Figure 11 Foxeer Monster V2 1200TVL



Figure 12 FPV goggles Eachine EV800

2.8. Radio Control

For remote control, TGY-i6S transmitter and TGY-iA6C receiver, depicted in Figure 13 and Figure 14, are used. They constitute a 10 channel 2.4GHz AFHDS 2A digital proportional computerized RC system. The AFHDS 2A (Automatic Frequency Hopping Digital System Second Generation) is specially developed for all radio control models. Offering superior protection against interference while maintaining lower power consumption and high reliable receiver sensitivity. Capable of sending and receiving data, transmitter is capable of receiving data from temperature, altitude and many other types of sensors, servo calibration and i-BUS/S-BUS support. This system bandwidth ranges from 2.408GHz to 2.475GHz. This band is divided in 135 channels. Each transmitter hops between 16 channels in order to reduce interference from other transmitters. Each transmitter and receiver has its own unique ID. Once the transmitter and receiver are paired, they only communicate with each other, preventing other systems accidentally connecting to or interfering with the systems operation. Weigh of the receiver is 7.9g and size 37.5x24.2x9.0mm.



Figure 13 TGY-i6S transmitter

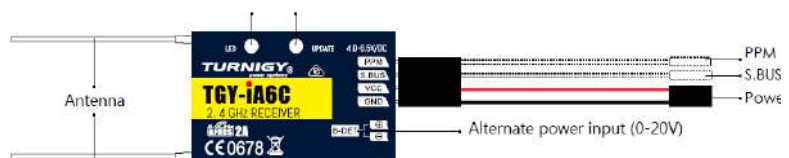


Figure 14 TGY-iA6C receiver

3. Programing and testing

Fully operational UAV is depicted in Figure 15. In order for the UAV to fly, it is necessary to program a flight controller.



Figure 15 Constructed UAV

Betaflight, depicted in Figure 16, is flight controller software (firmware) used to fly multi-rotor craft. It supports almost all flight controllers that have an STM32F4 processor and supports the majority of remote control manufacturers. ESCs are controlled using a variety of available protocols including PWM, OneShot, MultiShot, DShot or even ProShot. Betaflight allow the control of many VTX and Camera settings directly from the flight controller. Further, the steps required for basic UAV setup are given:

1. First, if propellers are mounted, it is necessary to remove them. UAV is very dangerous device and spinning propellers can injure. Connect antenna.
2. Connect flight controller with Betaflight using USB cable.
3. Backup default configuration of flight controller.
4. Set flight controller to bootloader mode and flash firmware to the newest version.
5. Bind receiver and transmitter. This operation is not performed with Betaflight, but according to the instructions of the receiver and transmitter manufacturer.
6. Receiver setup in Betaflight – chose receiver mode and serial receiver provider.
7. Connect battery to UAV.
8. Receiver channel mapping – select proper channel map and verify roll, pitch, yaw and throttle channel.
9. Set up arming switch – don't relay on this switch as safety. If the battery is connected threatened UAV as loaded gun.
10. Set flight mode – optional.
11. Set ESC protocol and make sure the motors are spinning using Betaflight interface.
12. Disconnect USB cable and test transmitter – arm UAV and see if the motors are spinning.
13. Turn off transmitter to check Fail-safe. Fail safe mode that enables a drone to move to the place where autonomous take-off and land safely when the sudden loss of communication between flight FCC and controller occurred [6]. In addition, it is possible to set it to turn off UAV and crash it to the ground in case of Fail-safe activation.

14. Select FPV channel using VTX control button. The selected channel will be displayed on a small 7-segment screen next to the button.
15. Mount propellers and you are ready to fly.

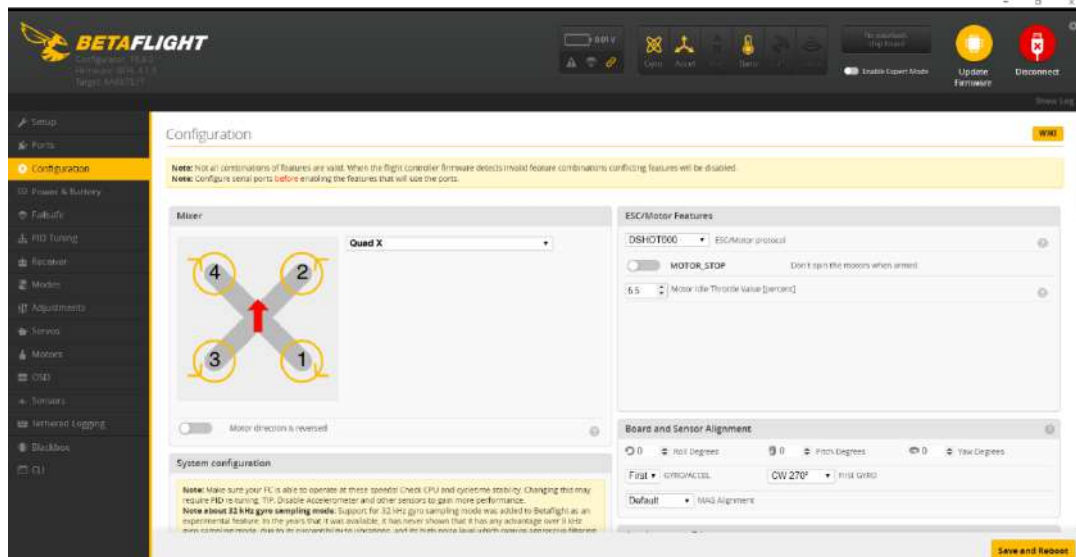


Figure 16 Betaflight software

4. Conclusion

This paper describes the process of building a UAV with FPV and a control system. The basic components used in the construction of aircraft are presented. Limited use of drones is largely related to the short time of flight, associating with the discharging of the battery powering it and the necessity of recharging. In addition, a major drawback is the need to ensure optical visibility between the UAV and the transmitter. Therefore, this type of UAV serves only for hobbyists and educational purposes. Future work will focus on the development of the UAV mathematical model in order to optimize PID parameters.

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PROFESSIONAL PAPERS

DEVELOPING BUSINESS COMMUNICATION STRATEGIES THROUGH EMOTIONAL INTELLIGENCE AND CULTURAL AWARENESS

Elena Ciortescu

Faculty of Economics and Business Administration, Alexandru Ioan Cuza University
Iasi, Romania
crismonais@yahoo.com

Abstract. Successful business communication implies a wide array of skills, most of which require not only professional training but also hands-on experience. While, in terms of business communication, students can benefit from professional training due to the LSP curricula (which is primarily aimed to meet their needs), hands-on experience is an acquisition which depends on many factors independent from universities' curricula. However, nowadays, with so much emphasis on students' need to acquire skills meant to help them cope with increasingly challenging realities, trainers seek to identify new methods to familiarize them with close-to-life situations. Consequently, the focus is on identifying the means by which business students can be brought closer to professional contexts by helping them acquire some particular skills essential in real-life situations: emotional intelligence and cultural awareness. Underlying a wide range of situations (presentations, meetings, negotiations, small talk, e-mails, reports, job applications, etc.), either oral or written, successful business communication is an extremely complex phenomenon which, in order to be achieved, requires the acquisition of skills which go well beyond language accuracy. The aim of this paper is to discuss the importance of cultural awareness and emotional intelligence in the context of business presentations. The first part of the paper will provide an insight into our particular context: our faculty, students, the status of ESP within our institution, COVID-19 crisis management. The second part of the paper is focused on the increasing relevance that cultural awareness and emotional intelligence have for LSP, in general, and for BE, in particular. Finally, the third part of the paper deals with the practical means by which cultural awareness and emotional intelligence can become inherent to the process of teaching BE oral communication skills, i.e. presentations.

Key Words: ESP, cultural awareness, emotional intelligence, presentations

1. Introduction

Business English classes, i.e., lectures and seminars, are optional for first and second year undergraduate students at the Faculty of Economics and Business Administration, "Alexandru Ioan Cuza" University of Iasi, Romania. Students can choose among 4 foreign languages (English, French, German, Spanish) a discipline that they are required to study for the first 4 semesters (2 hours per week) of their undergraduate studies. Depending on their specialization or choice, they may continue the study of English during the third Undergraduate year (as is the case of students in International Economics and Business) or during Master programmes (there is constantly an average number of 5 master programmes which provide Business English/ German lessons). While their expectation is to achieve the ability to communicate fluently in at least one foreign language, both in writing and orally, our

students' initial level of English remains extremely heterogeneous (ranging from A1 to B2). Therefore, the general aim we set is to enable them to acquire the ability to communicate fluently in English, in both professional and personal contexts. This aim can be achieved by ensuring the implementation of programmes in which *content*, *language* and *communication* are combined in order to develop the learner's language knowledge and communication skills (Brieger, 1997: 16-17). Our students' main needs revolve around three essential aspects: *accuracy*, *fluency* and *effectiveness*. In Romania, as throughout Europe, English is taught since very young ages; therefore, most of our students have been at least exposed to it for approximately 12 years before coming to University. However, due to various reasons, students fail to acquire the ability to communicate effectively; moreover, in the context of online lessons, which have been the standard of the Romanian higher educational system in the March 2020 – March 2022 period, valuable skills have been overlooked in most communication classes, business English included. Simple, once natural things, which required little explanation, such as: use of gestures, eye-contact, mastering of context-related structures – became abstract notions due to absenteeism and turned-off cameras. This has dramatically contributed, in a negative sense, to our students' (the so-called COVID-19 generation) incapacity to deal with a spontaneous communication situation in which you can see and, on your turn, be seen.

One of the main aims of any business English trainer is to identify their students'/ trainees' needs so as to be able to meet them. Beyond hard, technical skills, business professionals need to acquire the ability to adapt to the global context; the ability to communicate effectively; the ability to relate and interpret meaning; the ability to discover and use cultural information; the ability to decode non-verbal communication. Therefore, awareness of the cultural diversity and cultivation of emotional intelligence are as relevant to business trainers' attempt to meet their students' needs as use of grammar, specialized vocabulary and traditional skills (i.e. reading, writing, speaking, listening). The COVID-19 pandemic has had serious effects on our ability to communicate, i.e. to relate, to build rapport because these processes – essential in building trust and relationships - imply 2 simple though essential prerequisites: self-awareness and mutuality. As Daniel Goleman (2018) clearly pointed out, these two issues are inherent to emotional intelligence. Students' possibility to choose whether to be seen or not while "attending" classes has left most trainers isolated in front of screens populated solely by initials. This possibility to hide behind a turned-off camera has deprived students of the ability to take on responsibility for their actions and has further enabled them to avoid any direct consequence for their behaviour during classes. For these reasons, on-line attendance could be described as "half-being" behaviour. As I have already stated, on-line classes have proven detrimental to the process of acquiring two basic human values: self-awareness and mutuality. Both are essential to teaching, in general, and to teaching Business English, in particular. Both are fundamental to any act of communication, business communication included. Nevertheless, despite all odds, we have continued to implement the 4-semester Business English syllabus agreed upon before the pandemic outburst: while in their first undergraduate year (lectures and seminars, 2 hours each, once every two weeks) students were introduced to functional grammar in business contexts and specific accounting, finance and management vocabulary so as to familiarize them to the field of ESP, during their third and fourth semester (second

year of undergraduate studies), they were introduced to broader topics, meant to capitalize on a wider array of skills: business across cultures, marketing-specific vocabulary, international business meetings, negotiations and presentations, the job application process. In studying marketing-related vocabulary, for example, students become actively engaged in specific activities. Most often, the study of marketing-related vocabulary is followed by a product presentation that students have to deliver during a seminar. They enjoy using the newly acquired vocabulary (e.g. 4 Ps, distribution channel, accessibility vs. availability, promotion, sales) and experiencing on the newly introduced marketing strategies in a hands-on experience, i.e. by delivering a presentation of a product they choose to “sell”. This is also a very good opportunity to assess and provide them with feedback on their presentation skills.

It is thus particularly during the second year of study, in the context of the above skills' acquisition, that the importance of emotional intelligence and cultural awareness is revealed.

The next part of the paper will outline the high relevance of emotional intelligence in any business setting as well as the way it is interwoven in successful intercultural communication which, on its turn, is essential to conducting business internationally or even globally.

2. Cultural Awareness and Emotional Intelligence in Business Settings

Emotional intelligence, a term first used back in 1964 by Michael Beldoch, has since become the focus of the works of researchers like Howard Gardner (1983), Stanley Greenspan (1989), John Mayer (1990), etc. Nevertheless, one of the most cited names in the field is that of Daniel Goleman (*Emotional Intelligence – Why it can matter more than IQ*, 1995) who was the first to identify the key relation between emotional intelligence and successful leadership.

Emotional intelligence is broadly defined as the ability to perceive, control and evaluate emotions. Goleman supports the idea that emotional intelligence (EI) overrides IQ (intelligence quotient) particularly in the so-called “humanities” where the intellect is less relevant to the process of achieving success, i.e. in the fields where empathy and self-control could turn out more important than purely cognitive abilities (Goleman, 2018: 17). Goleman further insists on the fact that the fundamentals of EI, i.e. self-awareness, self-control, social conscience and network (human relationships) management translate into a successful career. Therefore, in order to become sound experts in customer service or teamwork, individuals need to acquire certain EI fundamentals, i.e. social conscience and network management (2018: 19). Goleman's theory nevertheless relates to the distinction between soft and hard skills. While the latter refer to the technical skills, most often acquired within a clear educational process (a good example would be the ability to prepare budgets or operate accounting programmes), soft skills (managing an intercultural team, conflict management, building rapport in professional contexts) are rather general features, which may be highly relevant in performing certain jobs and less in others. However, soft skills have been rarely (if ever) taught within educational systems and are, therefore, difficult to identify or assess. Nonetheless, the fact that university trainers have come to understand the rising importance of teaching soft skills and have consequently begun to shift focus towards EI in developing student-need-based syllabi reveals the growing importance of the field in the global business world, particularly nowadays when

confronted with tremendous challenges (the COVID-19 pandemic, the war in Ukraine, the fuel crisis). The abilities to understand ourselves, to understand the world, to negotiate meaning, to empathize and to manage conflict prove essential in such a context.

As Oana Ursu argues in her 2022 article, *Unpacking Cultural Intelligence in the Business English Classroom*, “the present day business environment is turning increasingly global (...) This state of affairs has put a spotlight on the need for developing multicultural skills in citizens all over the world and engaging them in cross-cultural learning experiences as much as possible. Therefore, developing intercultural competence in (business) students is turning into a prerequisite in order to prevent possible pitfalls”. Moreover, as she further notes, “this entails that awareness and understanding of cultural differences are no longer optional, but essential elements of the skillsets that business students need in order to secure their academic and career success in the present-day global village” (2022). Ursu also refers to CQ (cultural intelligence) and refers to it as an individual’s ability to actually function in culturally diverse environments which, although clearly drawing from EI, moves further into the complex realms of culture.

Thus, given the worldwide as well as the local context, developing a skills-based syllabus for business students must undoubtedly rely on two guiding principles: emotional intelligence and cultural awareness, i.e. hard skills must be interwoven with soft skills in the complex process of teaching business communication. The primary aim of business English is to achieve successful business communication (written, oral and even non-verbal). Communication may be defined in many ways; however, the definition which best suits our context is the one provided by Schacter in 1951: “Communication is the mechanism by which power is exerted” (apud. Jackson, 2020: 55). After all, any act of communication is aimed to exert influence, i.e. to persuade the addressee(s), to urge them to act in a certain way.

The best means to exemplify the means by which emotional intelligence and cultural awareness are interwoven in business English training is by providing some insights into delivering business presentations – a skill which is indispensable to any professional nowadays, in general, and to business professionals, in particular.

3. Emotional Intelligence and Cultural Awareness in Delivering Successful Business Presentations

Delivering business presentations is clearly related to the more general field of *public speaking*. It is widely acknowledged that one of the greatest fears most people experience, at least once in their lifetime, is that of public speaking. The emotional “burden” that such experience implies may be dealt with by engaging emotional intelligence key principles: by perceiving, controlling and evaluating their own and the audience’s emotions, speakers may get closer to achieving their purpose, i.e. to deliver a successful presentation, to persuade and to urge action on behalf of the audience. For all these reasons, the ability to deliver presentations in a professional setting should be among the aims of any business English/ business communication syllabus. Beyond the linguistic structures that students need to become familiar with in order to be able to build a coherent discourse, beyond the register-related aspects they need to distinguish and use appropriately (mostly depending on the audience and topic),

students need to be aware of some key cultural factors and of the emotional intelligence principles that could prove extremely useful in these circumstances.

Culture is by far one of the most complex terms, whose definition could easily cover hundreds of pages. Its relevance in the field of business communication (among many others) is crystal clear. Moving closer to our topic (i.e. presentations), culture is among the key aspects to be considered because, as we all know, while a presentation may be successful in front of an American audience, it may not go very well with a Japanese one. This difference in terms of receipt occurs as a consequence of the speaker's misunderstanding of audience's expectations which, on their turn, are determined by their cultural profile. A high-context culture by definition, the Japanese, for example, will feel more comfortable in a formal atmosphere, where the communication style is rather quiet and polite. On the contrary, as a low-context culture, Americans will expect a good speaker to be able to "sell" himself, to be assertive and to use humour and self-irony to that end. Therefore, we may assume that an informal presentation which goes perfectly well in the US may be considered unprofessional in Japan, for example. Thus, cultural awareness, or as Ursu puts it, CQ, which may be acquired by familiarization with E.T. Hall's, Geert Hofstede's, Martin Gannon's, Jane Jackson's works (to name just a few), proves essential to any professional in the global business world. As Richard Lewis stated in his 2014 article, *Teaching Cultural Competence*, "the English language (...) cannot exist in a vacuum or be disembodied from its speakers with their innate sense of time, space, authority, appropriacy, morality and sensitiveness" (Lewis, 2014: 8-9).

Intercultural knowledge starts from the assumption that the "global citizen" must recognize and respect cultural diversity, that they must be able to adapt and actively respond to their partners' needs and expectations, i.e. they must be able to *empathize*. Therefore, emotional intelligence is inherent to cultural awareness and vice versa. As for how these relate to public speaking, in general, and business presentations, in particular, let us turn to the two pillars which contribute to delivering a successful speech (either in politics or business, in education or elsewhere): *building trust* and *influencing*. These two obviously draw from emotional intelligence since they both imply the process of dealing with emotions (recognizing and coping with one's own as well as with the others' emotions, empathizing, controlling and using emotions in a positive, mutually beneficial way).

In acquiring presentation skills, students must understand that there are three key prerequisites that must be fulfilled: know the topic, know the language, know the audience. While the first two are related to an individual's hard, technical skills, the third one taps into the realms of emotional intelligence and cultural awareness. It is by knowing the audience that the speaker can identify their cultural background, their expectations, thus advancing towards building rapport, delivering the message and, finally, urging action.

While E.T. Hall's low vs. high-context cultural dimension still serves as a valuable resource for differentiating among communication styles worldwide, Jane Jackson points to the fact that, in order to achieve successful intercultural communication, it is important to bear in mind the danger of overgeneralization and stereotyping. To this end, she draws a list of thirteen suggestions, most of which relate to emotional intelligence, more precisely to the extent individuals are capable to perceive, control and evaluate their own and the addressees' emotions:

- “1 Be patient. Allow more time for the interaction.
2 Try to avoid the use of idioms (...); jokes and sarcasm do not translate well across cultures (...).
5 To gauge how your message is being received, be attentive to the other person’s verbal or nonverbal behavior (...).
7 Listen attentively and pay attention to both verbal and nonverbal messages of your communication partner before responding (...).
9 Be sensitive to the benefits of convergence and the potential negative consequences of divergence in terms of your speech/ communication style and language choice.
10 Be sensitive to the cultural beliefs, values, gender differences, and politeness norms that may underlie different styles of communication (...).
11 Recognize your personal style of communicating and make an effort to determine how your communication partners are perceiving you. Effective intercultural communication requires a high level of self-awareness and listener sensitivity.
12 (...) Adapting your communication style to put your interactant at ease may help you to create a positive impression and facilitate your communication.” (Jackson, 2020: 76-77)

More than half in thirteen suggestions relate to emotional intelligence, pointing to the importance of anticipating, if not knowing, communication partners’ needs and expectations, i.e. of empathizing. Consequently, it is not exaggerated to assume that, to a great extent, successful intercultural communication relies on emotional intelligence: the ability to manage one’s own and others’ emotions so as to ensure the successful delivery of a message, able to cross generations, social gaps and cultural differences.

At the beginning of this paper, I have stressed on the importance of practice or hands-on experience in higher education. The question which thus arises is: how do we insert practical experience in our students’ emotional intelligence and cultural awareness acquisition process? As stated, I have limited my discussion to business presentations. Departing from the idea that a public speaking act and, therefore, a presentation, is an attempt to persuade a group of people to act in a certain way, and that, sooner or later, we all have to deliver a presentation, in a professional (or even personal) context, I try to motivate students to understand that this skill is extremely useful for their development. The best means to keep them engaged is by means of powerful examples – and this is where the practical part comes into play. By watching/ listening/ reading a presentation delivered by someone they admire (or at least have heard of), by introducing the context in which it was held, their interest is stirred and new information (culture-related as well) is acquired. The importance of emotional intelligence is revealed by analyzing the beginning of any relevant speech. If we take, for example, Steve Jobs’s 2005 speech, “You’ve got to find what you love”, the chances that business students (both undergraduate and graduate) be interested in it are quite high. They will be curious about the context of the speech (2005 Commencement Ceremony, Stanford University, California) and its outcomes. The speech is by far one of the most influential worldwide and this is due to the topics approached - what is essential and how to succeed in life - and to the speaker’s background. The speech has had a huge impact, not only on the first-hand audience (Stanford graduates of

2005) but on almost anyone listening to/ watching/ reading it today. It is the speaker, the topic and, particularly, the self-awareness and sincerity which pervade the whole discourse that ensure its global impact.

Since the focus of this paper is on how we identify, assimilate and use emotional intelligence in (business) presentations, we will only discuss the practical means by which these may be achieved in the introductory part of a presentation by using Steve Jobs's 2005 speech as a case in point.

It is during the introductory stage of a presentation that speakers build rapport with the audience and display their trustworthiness, i.e. it is during this stage that emotional intelligence is first manifested and, thus, the foundation of a successful communication act is set. This is achieved by taking some simple steps: greeting the audience, introducing the topic, stating the duration of the talk, inviting questions from the audience. Rapport building, on the other hand, implies a two-fold approach: first, the speaker needs to display his trustworthiness and then, to ensure the audience he/she is familiar with and will further meet their needs and expectations (empathy). Trustworthiness is achieved by introducing oneself, by relating to well-known personalities (by quoting them, for example) or simply by one's own reputation. The feeling that the speaker knows the audience, that he/she relates to them may be achieved by multiple means: some speakers use storytelling to relate to the audience's emotional background, others use humour and self-irony. Also, as Braj Mohan rightfully notes, in order to build rapport, some speakers may resort to "sharing a goal, showing association with the audience, addressing them by name or designation (...)" (Mohan, 2019: 60). The same author identifies six strategies which may be used to connect with the audience: by showing association based on gender, class, place; by identifying a common cause; by invoking cultural factors which are relevant to the audience; by using inclusive pronouns (we, our, us); by sharing interests and commitments (Mohan, 2019: 74). In our case in point, Steve Jobs does not need to work on building his trustworthiness for his reputation requires no further validation. Nonetheless, he does need to ensure that he builds rapport with the audience, that his message will be conveyed successfully and that he will finally exert positive influence on their future development. To this end, he chooses storytelling as a means to connect with and to identify his audience's needs and expectations, i.e. to express his empathy, to capitalize on their emotional backgrounds and to thus ensure his own emotional wellbeing during the experience: "Thank you. I'm honored to be with you today for your commencement from one of the finest universities in the world. Truth be told, I never graduated from college and this is the closest I've ever gotten to a college graduation. Today I want to tell you three stories from my life. That's it. No big deal. Just three stories." (<https://news.stanford.edu/2005/06/14/jobs-061505>)

By telling the audience he is honoured to be there on their commencement day "from one of the finest universities in the world", Steve Jobs makes sure that the audience is aware of his high appreciation and modesty displayed in a humorous note: "(...) I never graduated from college and this is the closest I've ever gotten to a college graduation." Aware of the fact that, quite often, rush and lack of patience are young generations' specific features, in an attempt to show his understanding (empathy), he informs them from the very beginning that his speech will not take too long "(...)That's it. No big deal. Just three stories.", that he will keep it short and simple (another business presentations' golden rule).

Steve Jobs's 2005 Stanford Commencement speech is one of the best known worldwide. It would be but redundant to insist on the reasons why it is one of the greatest in all times. It is then, undeniable, that it could serve as valuable teaching material for business (and not only) students in their attempt to acquire presentation skills based on the use of emotional intelligence, cultural awareness, rhetorical and persuasion techniques.

4. Conclusions

Although many voices argue that it is impossible to measure or assess EQ (emotional quotient) through psychometric tests and that, therefore, emotional intelligence remains but a means of describing interpersonal skills, the importance of building rapport in any communication setting, in general, and in business contexts (from socializing to negotiating, from meetings to presentations), in particular, has been long stressed upon by numerous researchers in the field of communication. Consequently, now, during post pandemic times and with a terrible war threatening world balance, it is even more urgent that we find the track to basic values such as empathy, reciprocation, self-discipline and responsibility and to further implement them in the educational process so as to ensure a common path towards resilience and sustainability. The inclusion of cultural awareness and emotional intelligence principles in the universities' curricula would mean a great step taken in this direction; moreover, it is by raising awareness of the importance of emotional and cultural intelligence that the first steps towards proficiency in this field can be achieved. After all, in his three means of persuasion (ethos, pathos, logos), Aristotle seems to have anticipated the rise of emotional intelligence and cultural awareness as genuine fields of study and research.

By carrying out a short analysis on the reasons underlying the choice of a particular speech (Steve Jobs's in our case), students understand once more that, in any act of communication, it is essential and emotionally smart to meet the needs and expectations of the interlocutor/ partner/ audience and to respond to their interest so as to ensure rapport. Presentations are persuasive acts which rely on and appeal to essentially human features based on emotional intelligence: empathy, mutual respect, truthfulness and trustworthiness. If these aspects are kept in mind, the whole experience will prove successful for all actors involved: speaker(s) and audience, teachers and students.

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A QUESTIONNAIRE-BASED STUDY ON STUDENTS' PREFERRED LEARNING ACTIVITIES ALIGNED WITH CLT

Ivana Vodogaz

University Department for Professional Studies, Split, Croatia
ivodogaz@oss.unist.hr

Marijana Jurišić

University Department for Professional Studies, Split, Croatia
mjurismic@oss.unist.hr

Abstract. This paper investigated our students' thoughts and suggestions on the appropriate learning activities that are most in alignment with CLT and which usually take place in our classrooms. We came to conclusion that most students find communication skills to be the most important ones and that this segment of learning outcomes will be the one from which they will benefit the most. Accordingly, we opted for two short questionnaires completed by 120 students of our Department. In the first one, they decided on their favourite and most effective communication skills activities used in classes with the idea that successful mastering of a foreign language will result from real effective communication. It revealed that their preferred activities are group work and pair work. The second questionnaire investigated our students' attitudes towards these two types of learning procedures. Which one helps them more? Would they like to choose their own partners? Do they approve the current assessment methods? These were some of the questions which helped us to find out more about their preferences, suggestions, and ideas. Communication skills and approaches we use to improve those skills are extremely important in our daily work. Not all methods are equally successful, nor do all students have the same preferences at the same time. This paper wants to reveal our students' choices, analyse the comments they made in the questionnaire and present these methods as a suitable choice for achieving the competencies they strive for.

Key words: *communicative language teaching, questionnaire, preferences, activities, CLT,*

1. Introduction

It is generally accepted that the quality of teaching, especially the ability of teachers to motivate students is the most effective way to improve student learning and make the learning more effective. According to Williams and Burden (1997), student motivation is considered to have the strongest influence on learning. Language teachers need to decide how to implement and maintain motivation throughout the academic year. A language teacher needs to find engaging and educational activities that help students learn the curriculum and develop communication skills. To do this, they really need to understand how their students perceive effective language teaching. These perceptions may include students' preferences regarding the teaching method. (Lightbrown & Spada, 2008). Students' preference for learning activities in the language classroom can be influenced by a number of factors, such as, learning and teaching methods, motivation, students' attitudes towards the importance of some activities, classroom atmosphere and the level of language proficiency. At times, teachers need to make choices based on the possibilities available within a particular

group of students. Nunan (1999) suggests that choice of teaching methods should take students into consideration. According to Dörnyei and Ushioda (2011), learner preference for classroom activities has been associated with motivational factors, which influence learners' engagement in classroom interaction. For effective language learning and teaching, learners' skills and opinions should be in the focus of the teaching process and students should have the opportunity to express their preferences regarding the ways of teaching and learning the English language. Sometimes English language teachers face students' resistance or unwillingness when they tend to introduce a new instructional activity in the classroom. Some students want more opportunities to participate in free conversation, expressing their wishes towards a more communication-oriented approach. On the other hand, there are those who would prefer more individuality in learning English. We believe that the teacher, while implementing a type of activities in a language classroom, should take into consideration such learners' varieties of preferences. Understanding students' preferences towards teaching approaches and the use of appropriate activities can create opportunities for teachers to make choices that better serve their students.

2. Choice of classroom activities

Activities used in the classroom are important for learning in many ways. Activities might have positive and negative impact on students, depending on how teachers are able to make use of appropriate activities in the classroom. Bad choice of activities might also bring consequences such as demotivation, increasing anxiety or boredom. In general, choice of activities play an important role in the process of learning in the classroom.

It would be important to find out what an activity really means. Nunan (1991) defines the term "activities" as the elements of the task that specifies what the students will actually perform in the classroom; for instance, listening, writing a sentence, answering questions, etc. The literature (Moore, 2001; Nunan, 1991) explains that it is important to think about students' opinions for the selection of the activities and that a good selection of classroom activities involves students, makes the learning easier and more enjoyable, provides immediate feedback etc.

Although participation of students is a clear goal in EFL courses, use of activities can encourage or discourage students from doing so. Some studies have shown that certain activities as well as the atmosphere in the classroom interfere with students' communication performance. Teachers usually combine different teaching procedures. They prefer some classroom activities over others because of the effect that activities have on students. In most cases the choice of activities depends on their own preference. Rao (2002) argues that matching styles effectively can only be achieved when teachers are aware of students' needs, capacities, potentials, and learning preferences. The way a teacher approaches teaching can have positive and negative impact on learning process. What happens if the teaching style differs from students' learning style? Felder and Spurlin (2005) claim that in such cases, students might become discouraged and demotivated about the learning content. According to Kumaravadivelu (1991), teachers and students have their own opinions about what teaching, and learning are. He thinks that both teachers and students see classroom activities in different ways and these ways do not always match. It is not always easy to please students' preferences for activities; however, teachers' expertise and

knowledge about their classes can help in choosing activities that can create an environment where most learners feel motivated to participate and learn. This importance of knowing the activities that students like to have or do in the classroom will lead to students' involvement within the classroom environment, thus lead to attentive participation. Zhu (2012) found that interesting activities for students such as pair work, classroom games, debates and role plays can improve students' communicative ability.

3. The Communicative Approach

The communicative language teaching (CLT) or Communicative Approach (CA) is probably the best known modern standard approach to the teaching of foreign language based primarily on the idea that successful mastering of a foreign language will result from real effective communication.

CLT is considered as an approach and not a method since it is compatible with many teaching methods. There is no specific teaching methodology available for CLT. The availability of a teaching methodology would be typical for this method (Richards & Rodgers 2007). The focus is on emphasising interaction which becomes the means and the final goal of learning, and the result is so called communicative competence. When students participate in real communication, they use their natural strategies that they are not even aware of and thus unconsciously and more easily than using other ways, they adopt new material. Students are going to learn the language by using it for different assignments where they are supposed to take part in pair work, group work, role play, and discussion inside classrooms.

3.1. Characteristics of CLT

- The focus is always on meaning and appropriate usage – not grammar, vocabulary is considered prior to syntactic structures. Less emphasis is put on grammar, teacher monologues, direct repetition, and accuracy but we must provide the opportunities for our students to develop accuracy as well as fluency. Communicative functions always come before linguistic structures.
- Instructions are always learner oriented.
- Teaching/learning activities (procedures) that are aligned with CLT are pair work, small-group tasks, role plays, and dialogues, students will use these opportunities to try out what they already know and what they have just learnt, all these activities will show the functional use of the target language.
- Instructional materials should always be as authentic as possible, reflecting real life situations.
- All language skills (listening, speaking, reading, and writing) should be fully integrated in every possible way. This means that teacher's role is to develop the best possible procedures for teaching those skills.

4. Group work

According to our study, many of our students feel as though they can accomplish assignments better through group or pair work. Group work as a teaching method (activity) appeared in the 20th century, gained more and more supporters, and the

importance of social learning was increasingly emphasized in the literature (Bennet 1995). However, according to Terhart, it still takes up only 7% of teaching time.

Matijević defines group teaching as a "social form of work that is characteristic of internal dynamics and didactic values" (Matijević 2002). Group work belongs to the methods (activities) of active learning which is characterized by a temporary division of classes in smaller sections (Terhart 2001).

Regardless of the group work activity, the teacher's task is to organize a group of students. It would be best if the group consisted of four to six students (Bennet 1995), however the number of members depends on the nature of the task as well as the type of communication teacher wants to achieve (Matijević 2002). It should be noted that in larger groups, of course, there is the possibility of "(self) isolation of individuals and slackers" (Matijević 2002). The way the group is formed is very important and depends on the differences of the students and the type of task which students should work on (Matijević 2002). Groups can be spontaneously formed, or teacher can form them according to a certain criterion (Schweizer 1964 according to Matijević 2002), such as the level of student's linguistic competence. In this case, heterogeneous groups are preferred (Schweizer, 1964 according to Matijević, 2002). Bennet reports Cohen's research according to whom, work in heterogeneous groups allow students to use each other as sources of help. Depending on the attitude towards the task, all students in the group can work on the same task or each one can work on his own (Bennet 1995).

When working in a group, it is very important that each member of the group knows what his/her task is. Each group divides its task into several smaller ones where each member then gets their part. It must never happen that some members of the group passively observe, while others work - group work means the joint work of all the members. Each group can choose its leader who is then responsible for that group and who makes sure that all members are employed and that everyone knows what they are doing and what their task is. Finally, when all groups are done with their tasks and after each group has presented its result, it is necessary to make a synthesis of all results so that each student can connect their result with other results. This allows students to present their opinions, criticisms, praises, and new findings. The teacher should never be passive during group work. At the beginning of group work, the teacher gives general instructions for the whole class, and then, after dividing the tasks, individually gives each group individual instructions, advice, provides the necessary materials and literature (if necessary), etc. Finally, when all groups have finished, the teacher evaluates the work of each group - evaluates the results, methods used, activity of individual groups and group members and finally, most importantly, assesses how much students have adopted the material through group work. Each group and each member of the group must be able to turn to the teacher for help at any time, if he or she needs it. The teacher monitors the situation - how each group progresses, controls them, guides, advises, praises, but also makes remarks. He/she monitors the work of all groups and in a certain time interval checks the work of each

group and points out errors, coordinates and possibly, if necessary, provides additional information .

4.1. Phases of group work

1. preparatory phase
2. operational phase
3. verification phase
4. application phase

In the preparatory phase, groups are formed, and tasks are scheduled. After the task is given, and after the instructions are given, the group leader is selected within each group and then the task is divided into several smaller tasks from which each member of the group gets a share. The operational phase implies work on the task, that is, its realization. The verification phase is primarily used to present the obtained results. The application phase is the phase of practical application - the result of each group can be included further in the class and is used later for solving other problems and tasks.

4.2 The most common forms of group work

1. several groups work on the same task
2. several groups work on different tasks
3. several groups work on the components of the same task.

The work of several groups on the same task is the one where all groups regardless of the level of progress are given the same task. In this way, cooperation between group members is developed, especially if there is a certain form of "competition" between groups. Another important advantage of this form is that less time is needed to design the task. Working in groups on different tasks means that each group is given a different task, depending on the capabilities and abilities of the group members. This form is a bit more demanding for the teacher because it is necessary to design a task for each group, paying attention to the difficulty of the task. Working on the components of the same task is the one where each group gets its own task which is part of a complex task. The most interesting part of this kind of work is the synthesis - when all the groups are done with their tasks, it is necessary to combine them into one whole and come up with a solution to a complex task.

4.3 Advantages and disadvantages of group work

The main advantage of group work is that students are placed in a direct relationship to the teaching content and its source. It is possible to develop social skills - group work requires communication, agreement, consultation, commenting on actions, but, in addition to these communication skills, it requires respect for individual differences among students, tolerance, self-esteem, self-control, respect for others, willingness to express opinion in situations that require it. Students are more independent, more active, they can solve the task in their own way and develop positive personality traits - sensibility, coordination, social learning, cooperation, acceptance of interlocutors and associates, culture of dialogue, accuracy, and independence. Students improve their working skills and the ability to work in a team (initially important for joint activities such

as games and sports, and later in life for work in the workplace), they are more relaxed, they dictate the pace and the way of working.

Possible disadvantages of this activity arise when some students sometimes passively watch while others work, more teacher involvement is needed in preparing the lesson.

5. Pair work

A pair can be considered a small group. Working in pairs encourages more intensive communication and cooperation to achieve the desired goal - both members must participate in the conversation, they argue and come to a solution (Matijević 2002), which means that working in pairs does not leave space for student passivity. Students control each other and encourage each other to work (Matijević 2002). It is important to determine the roles within the couple, just as it is within the group. Both members can work independently and finally discuss what they did or jointly seek a solution (Matijević 2002). Furthermore, all couples in the class can do the same or different task. The task can also be divided into several parts so each group can do their part or a group of couples can work on one part of the task while other groups of couples work on other parts. The role of the teacher is, again, to organize the class into pairs. The teacher can distribute students in pairs according to some criterion and can also leave the choice of pairs to the students. Also, the teacher should control the students – he checks if it is clear to them what they are doing if they accept one another and what is their cooperation like (Matijević 2002). Not all materials are suitable for this method, therefore "group teaching should be prepared thematically" (Terhart 2001, 171). At the end of the task, different group results need to be integrated or, at least brought into mutual relation" (Terhart 2001, 171).

This teaching method is the most successful when students are asked to share understanding, knowledge, and skills with each other, achieving a common goal through some form of problem-solving tasks (Bennet 1995). It is also important to think about the type of learning that is encouraged, and in this case, it is cooperative learning (Terhart 2001).

Pair work is great for practicing model dialogues, playing games such as battleship, conducting vocabulary checks, and completing worksheets. Working in pairs gives individual students a lot of speaking time. If working together, students will often have more confidence than when completing exercises individually. If students are competing with their partners, they will be more motivated.

5.1 Phases of work in pairs

There are three phases:

1. preparatory phase
2. independent research work of couples
3. presentation

In the preparatory phase, pairs are formed, the number of pairs and each pair is assigned their task with the exact goal. During the phase of independent research work of couples, the task is realized, that is, each couple solves its task, and in the presentation phase the obtained results are combined and presented to other couples. Characteristics that students develop through this form of work are, among other things, abandoning the egocentric attitude of students, the ability to understand and

accept other people's views and attitudes, nurturing collaborative relationships in socializing and learning and awareness that working together achieves better results.

5.2 Advantages and disadvantages of pair work

The advantages of these types of activities are huge. The knowledge that students acquire through group work is longer lasting, (Terhart 2001 according to Meyer 1986) which guarantees better success (Jensen 2003), it is of better quality, and the achievability of goals is for longer term. Pair work can be understood as a subtype of group work with the difference that there are always only two members in a team. They can work together in class, but also outside of it, writing seminars or homework, learning and so on. In this form of work, students can discuss the topics covered or the tasks they must solve. In this way, they also learn from each other, support each other, control each other, correct, supplement, and teach.

Working in pairs also has a positive effect on classroom discipline - students' "chatting" with each other turns into useful conversation and active work, and it is often much easier for students to communicate with their colleagues rather than with teachers. They are closer to each other; they can understand each other better and they can explain their problem in a more relaxed manner without the fear of being criticized. Of course, it can always happen that some students do not have understanding or patience, so the prerequisite for pair work is the work discipline of both partners (that both partners respect the agreed obligations to work together), mutual helpfulness and shared interest for work.

6. Objectives of the survey

The focus in our classroom should always be a real communication. Teachers have a great responsibility to create the atmosphere which will promote better communication. We want our students to learn to communicate and the best way to achieve this goal is by communicating. It's important to mention that exercises and activities are chosen according to our students' interests, but unfortunately, there is a curriculum that we are all obliged to follow.

Cooperative learning has become a common practice in both EFL and ESL classes. This teaching approach is believed to provide a more motivating and supportive learning environment than individual work. However, as we did not have clear evidence of the advantages, we decided to conduct research to investigate students' opinion.

This research sought to find out the specific learning tasks that individuals feel are most adequate for their linguistic growth and to identify students' perceptions and preferences for certain classroom activities. This study consisted of a questionnaire-based survey administered to 95 first-year students of Management of Trade and Tourism and Accounting and Finance at the University Department for Professional Studies. Before the students completed the questionnaires, the students had been given brief instructions and pointed out that there were, no right or wrong answers. It was also made sure that the students understood that their answers should reflect on their beliefs, thoughts, and feelings. The questionnaire consisted of two parts.

The first part contained 4 questions regarding students' attitudes towards EFL learning. The questions focused on language teaching approaches most used in their English classes.

After the results of the first questionnaire had been analysed, the students were given the second one which focused on different aspects of group or pair work. The first questionnaire clearly pointed out that these were their preferred classroom activities. They were also asked to express their opinion regarding their active involvement in the classes and whether they believed that they should have more oral participation. They also expressed that group work can also be used for improving their vocabulary or grammar proficiency, thus group work facilitates the learning.

7. Results and discussion

7.1 The first questionnaire

The first question in this questionnaire deals with the competences that our students would like to acquire, so 87% of them believe that communicative competence is the most important one, 10 % of students will choose grammatical/linguistic competence instead, while only 3% choose both as equally important. Furthermore, 55% of students think that vocabulary acquisition is the most important one, 18% of students choose grammatical development and 20% of them believe that grammar and vocabulary proficiency are equally important. In the third question, students were offered several different classroom activities for which they had to decide whether they can help to achieve the second language fluency and communicative skills. According to them, reading in English, writing in English, watching short videos, listening, and summarizing, group work, pair work and individual work are marked as useful. On the other hand, reading aloud in English, listening to music, imitating English-native speakers are seen as not helpful. In the last question, the students were asked to choose the language learning activities which, in their opinion, can improve the development of communication skills in the language classroom (Figure 1). They could choose from ten options. The overall results indicated that our learners strongly preferred activities such as group work or pair work when compared to other classroom activities. Furthermore, the results showed that the least preferred activity was individual work.

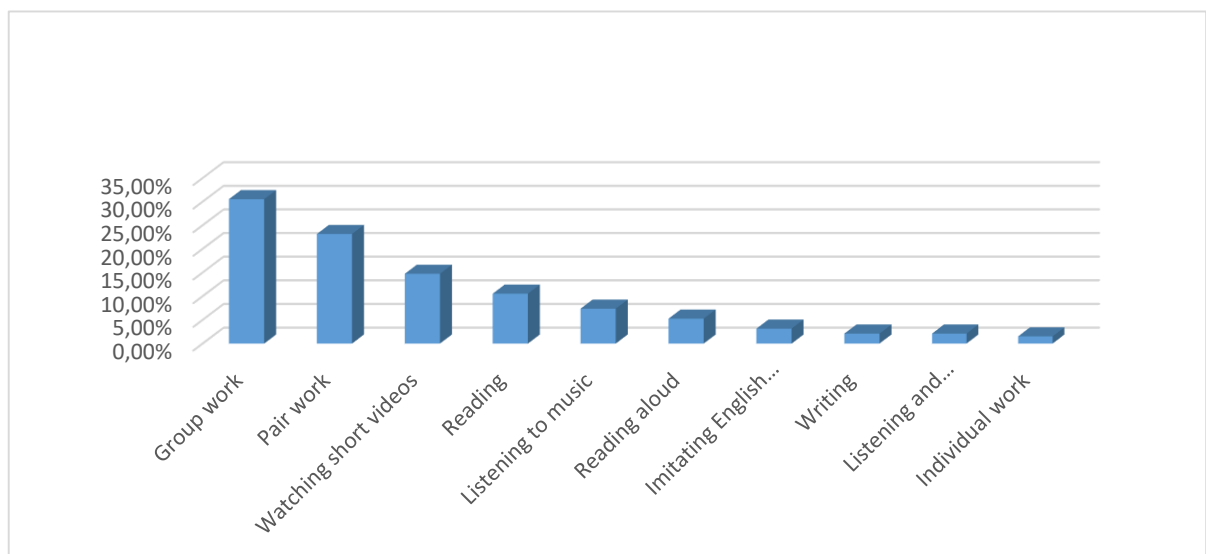


Figure 1 Students' preferences of learning activities

7.2 The second questionnaire

The findings of the second questionnaire suggest that 37,5% of students would like to use pair work more often while 31,25% believe that we should use group work more. They also think that such activities can help them master the grammar more easily and 87,5% find pair/group activities useful for mastering the vocabulary. Interestingly, they do not think that the activities practiced in the classroom need to imitate authentic business situations. Furthermore, 87,5% of our students would like to be able to choose working partners on their own. It is interesting to note that 68,75% of students think that it is fair that the teacher forms the groups according to the participants' prior knowledge while 32,25% believe that is not important. Most students, 68,25% said that they are not affected if there is someone in the group/pair who doesn't participate but waits for the other(s) to do all the work. 75% of student think that, after group/pair work has been finished, the teacher should evaluate or give remarks and praises to group as a whole and only 25% believe that praise should be given individually. Surprisingly, 75% of students think that they speak just enough during the classes while 18,75% of students believe they speak too little. Similarly, the majority, 68,78% of our students, find that the teacher also speaks just enough and 25% of them think that the teacher speaks too much. Finally, 81,25% of students said they would not like to speak more during the classes (Table 1).

Table 1 Analysis of the second questionnaire

Question	a	b	c
Which of the following methods would you like to use more often?	Pair work 37,5%	Group work 31,25%	I don't care 31,25%
Can group/pair work help you master the grammar more easily?	Yes 81,25%	No 18,75%	
Can group/pair work help you master the vocabulary more easily?	Yes 87,5%	No 12,5%	
Is it necessary for these tasks to mimic business situations and environment?	Yes 18,75%	No 81,25%	
Which situation do you prefer?	Choosing your working partner(s) on your own 87,5%	Teacher choosing your working partner(s) 12,5%	
Do you think it is desirable that the teacher forms groups in a way that each of them consists of participants with different prior knowledge and possibilities?	Yes, this is fair. 68,75%	No, this is not important. 31,25%	
Is there someone in the group/pair who doesn't participate, but waits for the other(s) to do all the work?	Yes 37,5%	No 0%	Sometimes 6,25%
Does that affect you?	Yes 31,25%	No 68,25%	

Do you think after group/pair work has been finished, the teacher should evaluate or give remarks and praises to	group as a whole? 75%	each student individually? 25%	
.Do you believe that during the classes you	Speak too little? 18,75%	speak too much? 6,25%	speak just enough? 75%
.Do you believe that during the classes teacher	speaks too little? 6,25%	speaks too much? 25%	speaks just enough? 68,78%
. Would you like to speak more during the classes?	Yes 18,75%	No 81,25%	

8. Conclusion

The findings of this study suggest that both group and pair work are the classroom activities that can be used as a valuable tool for the students to improve their skills and deal with the course materials. The study also proved that students learn more effectively and are more creative when they are interacting with others. Placing students into groups may improve their productivity, increase their creativity, and facilitate the learning. In this way, students are more included in the learning process. Such patterns of interactive teaching enable students to interact with their classmates, apply acquired knowledge in new circumstances, but also to successfully achieve the shared goal. Additionally, students' cooperation is likely to be encouraged. Students help one another and discover things together, which makes a task more likely to be completed successfully. Moreover, pair and group work provide variety during the lesson, at the same time being relatively quick and easy to organize, pair work and group work prove potentially beneficial from the point of view of the English language learning process. They also provide the students with many opportunities to use the language, especially for speaking. Working in groups is likely to increase the students' responsibility regarding the completion of the task. Language tasks are generally easier to perform in a pair or in a group. On the contrary, pair and group work increase satisfaction and self-confidence of the students, which, in turn, results in higher motivation

Many studies have shown that CLT is recognized among students as extremely motivating. It simply makes the language learning more interesting. We could see that it really helps students to improve their fluency, performance, and pronunciation, moreover it helps them to improve communicative proficiency of all four language skills and it helps to reach a final goal, which is the functional use of a foreign language. Of course, there are several problems that we need to take into consideration such as little time for developing materials, due to the curriculum of large classes that we often must deal with. In these situations, pair work and small groups work are extremely beneficial. In this way, we turn a large classroom into a series of small ones and create

a new artificial atmosphere in which we dedicate ourselves to small groups of students, one by one.

If it is properly prepared and introduced, group work can produce very positive and lasting results. Getting out of the comfort zone is a prerequisite for progress for both parties, students, and teachers, it is up to a teacher to convince students to be willing to accept challenges.

We also believe that it is necessary to point out certain shortcomings of these activities - it is time consuming (Terhart 2001), it requires teachers to hand over some control to students. That is why it is important that the teacher has good organizational skills.

There is no method for which we can say with certainty that is the best. We differ in possibilities as well as in desires, we do not feel comfortable or confident in every classroom situation, we are not motivated in the same way. It is natural to try to avoid the inconveniences that arise from such situations. Differences are inevitable among students, as well as between teachers, so we always come to a similar conclusion which is that the method, no matter what it is, will be successful only if it fully suits both the student and the teacher.

“Theorists are happy to talk about the benefits of group teaching. Practitioners are rather sceptical. Empiricism shows that group work is better than what theorists think about it, but also worse than what practitioners think about it.” (Meyer 2005, 81).

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ELEMENTS OF GAMIFICATION IN THE TEACHING PROCESS

Marinko Lipovac

University of Split, University Department of Professional Studies, Split, Croatia
lipovac@oss.unist.hr

Siniša Zorica

University of Split, University Department of Professional Studies, Split, Croatia
szorica@oss.unist.hr

Sandra Antunović Terzić

University of Split, University Department of Professional Studies, Split, Croatia
santunov@oss.unist.hr

Joško Smolčić

Craft Technical School Split, Croatia
josko1911@gmail.com

Abstract. Learning is the process of acquiring knowledge and experience. In recent years (at the time of the coronavirus pandemic), classical teaching has resulted in the transition to an online learning system. E-learning can be boring and tedious for both students and teachers. Digitization offers the possibility of introducing new techniques into the teaching process, which can stimulate students and their activity. Gamification is one such technique.

Gamification is the application of elements of gaming in non-gaming environments. The main purpose of gamification is to combine learning with fun. This ensures a longer commitment of students to a particular learning material and facilitates its mastery. Gamification is primarily associated with the notion of rewards. In most cases, gamification include scoring, levels, virtual rewards, ranking scales, tasks, developing players through a virtual avatar, time limits, etc. The principle of games is to define certain levels, and by overcoming certain obstacles, it moves to a new, more demanding, level.

The paper presents the elements of gamification in Moodle learning systems, their implementation in the teaching process, as well as some applications for creating interactive lessons, quizzes, crossword puzzles, mind maps, etc. The principles of operation of individual applications, their comparison, advantages and disadvantages, as well as used elements of gamification will be described.

Key words: *Gamification, Moodle, Online learning*

1. Introduction

Learning is the process of acquiring knowledge and experience. In recent years (during the corona virus pandemic), classical teaching has resulted in the transition to an online learning system. E-learning, as well as classical teaching, can be boring and tedious for both students and teachers.

Digitalization is leading to a trend in which young people are spending more and more time on their mobile devices or computers. Most users of smart devices and computers, not just the younger population, practice playing online games. The global gaming market is estimated at \$ 177.8 billion in 2020 and \$ 198.4 billion in 2021, an increase

of about \$ 20 billion (*Gaming Market Forecast, Revenue, Trends | 2022 - 27 | Industry Growth*, n.d.).

Digitalization offers the possibility of introducing new techniques into the teaching process, which can stimulate students and their activity. One such technique is gamification. The use of gamification has certainly led to an increase in the activities and motivation of the students themselves. By using online tests and lectures, which students can access from anywhere and anytime, they give them additional motivation for further learning and research. Gamification models enable communication between students and teachers, work in teams as well as feedback in both directions.

Online test results give students the opportunity to compare their knowledge with that of other students. Those results also enable teachers to monitor the progress of individual students as well as to get insight into which material needs more work.

Gamification is primarily present in the field of information and communication technologies, but it is being increasingly applied in other areas, such as courses that require visualization in learning.

The paper presents the elements of gamification in Moodle learning systems, their implementation in the teaching process, as well as some applications for interactive lessons, quizzes, crossword puzzles, smart maps, etc. It describes the principles of individual applications, their analogy, advantages and disadvantages as well as the elements of gamification used in their work.

2. Gamification

Gamification is the application of elements of gaming in non-gaming environments. The term gamification is associated with the name of Nick Pelling (British programmer and inventor) who describes the concept of gamification and the advantage of its use. Although the term itself originated in 2002, the first documented use dates back to 2008, but the term was not used frequently until the second half of 2010 (Faiella & Ricciardi, 2015). Gamification has been identified as one of the emerging technologies that will have a major impact on educational institutions around the world (Pretty & Alam, 2018), and is considered a new approach that can bridge the generation gap between teachers and students (Kapp, 2012; Oblinger, 2004). According to the authors (Kim et al., 2018), gamification is "a set of activities and processes for solving problems by using or applying the characteristics of game elements". According to the same authors, gamification is not just one activity but a set of relevant activities and systematic processes, and its purpose is to solve specific problems. "The mere use of game mechanics, such as badges and points, should not be considered as gamification, but gamification itself should be based on elements of the game."

Gamification is defined by Deterding et al. (2011) as "the use of game design elements in non-game contexts". Deterding's definition distinguishes gamification from other related concepts in two dimensions: whole versus parts and playing versus gaming (Figure 1). The whole versus parts refers to how much the product or service uses the elements of the game, i.e. whether they use the game as a whole or only parts of the game. Gaming uses elements of the game that are related to the rules and outcome of the game (gaming) while playing (playing) contains only the aspect of playing (playing) (Matallaoui et al., 2017).

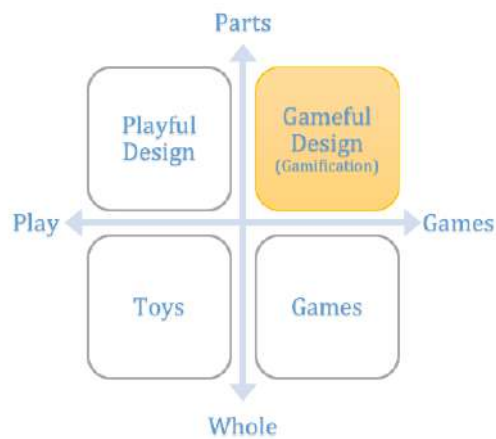


Figure 1 The relationship of gamification, serious or applied play, toys, and playful design according to Deterding

Gamification differs from serious play in that elements of game are used only in part, while serious games are complete games, but may have educational goals. The difference between gamification and playful design is that gamification requires a design based on rules and target orientation, while playful design contains only the aspect of playing.

In 2016, Wang and Lieberoth conducted research on how sound and scores affect student motivation. The analysis using sound, music, points and points, conducted on 600 students, had a positive effect on their interest and increased motivation (Wang & Lieberoth, 2016). This is not the only research conducted on this topic. In recent years, many papers and many studies have been written on the benefits of using gamification. The analysis of these researches shows that the application of gamification leads to increased student involvement in the teaching process, increased motivation, and in most cases to an increase in average grades, which is certainly a consequence of greater commitment and interest of students.

Figure 2 presents the benefits of using gamification, such as:

Better learning experience. The learner can experience "fun" during the game and still learn if the level of engagement is high. A good gamification strategy with high levels of engagement will lead to an increase in recall and retention.

Better learning environment. Gamification in e-learning provides an effective, informal learning environment, and helps learners practice real-life situations and challenges in a safe environment. This leads to a more engaged learning experience that facilitates better knowledge retention.

Instant feedback. It provides instant feedback so that learners know what they know or what they should know. This too facilitates better learner engagement and thereby better recall and retention.

Prompting behavioral change. Points, badges, and leaderboards would surely make training awesome. However, gamification is about a lot more than just those surface level benefits. Gamification can drive strong behavioral change especially when combined with the scientific principles of repeated retrieval and spaced repetition.

Can be applied for most learning needs. Gamification can be used to fulfill most learning needs including induction and onboarding, product sales, customer support,

soft skills, awareness creation, and compliance.

Impact on bottom-line. On account of all these aspects that touch and impact learners (better learning experience, higher recall and retention, catalyzing behavioral change, and so on), it can create a significant performance gain for the organization.



Figure 2 Benefits of Gamification in e-learning

3. Gamification in Moodle

Moodle is a learning platform designed to provide educators, administrators and learners with a single robust, secure and integrated system to create personalised learning environments. There are over 180,000 registered Moodle installations with over 213 million users worldwide (*About Moodle - MoodleDocs*, n.d.). The Moodle is written in PHP and designed with a modular architecture to be easily extendable. A Moodle installation consists of courses that students can join or be added to. A course consists of several activities which represent the provided learning resources. The available activities include an assignment system, quizzes, discussion forums, wikis and downloadable learning material. Additionally, other items such as calendars or recent activity verviews can be added next to the course activities in so called blocks. There are already some gamification solutions available for the Moodle, which will be presented in remaining subsections of this section.

The application of gamification on the Moodle system can be divided into three phases:

- planning phase,
- implementation phase,
- evaluation phase.

Planning is the process of thinking and organizing the activities needed to achieve the desired goal. This phase includes the choice of tasks and goals, actions to achieve them, as well as the choice between alternative future courses of action.

First of all, it is necessary to design and adapt the content of the course, and then single out the elements of gamification that could increase students' interest and general engagement in e-learning. Some of them will be singled out and described:

Avatar. An avatar is a graphic representation of a user, a user's character or a person. Avatars can be two-dimensional icons on online forums and other online communities, where they are also known as profile pictures, user pictures, or personal icons. Academic research has focused on how avatars can influence the results of communication and digital identity. Users can use avatars with fictional features to gain social acceptance or facilitate social interaction. However, studies have found that most users choose avatars that are reminiscent of their real world.

Badges. Badges are a good way to show small achievements and to show possible progress. They can be set for award based on the selected criteria and are fully compatible with Mozilla Badges. Badges acquired by students in Moodle can be displayed on the user profile as well as on their Moodle dashboard.

Multiple badge types can be assigned:

- In order to motivate students, it is possible to establish a range of activities that students need to do to receive a badge, such as participating in a forum, asking a good question and working hard.
- To measure student achievement, they receive a badge each time they complete a particular mission.

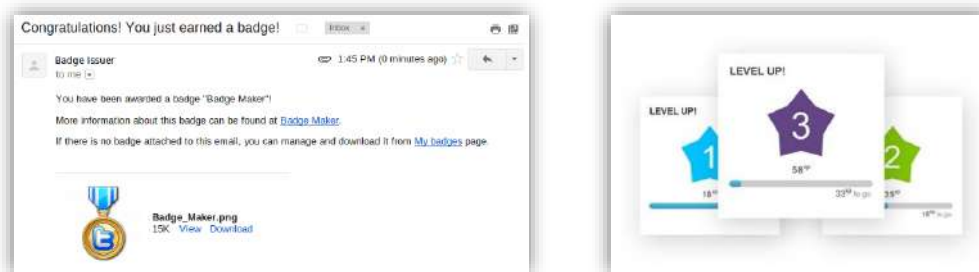


Figure 3 Badges, Experience Points (XP) and Levels

Experience Points (XP). Points can be awarded automatically when they complete a quiz or similar, as well as for performing certain actions in an e-learning course, such as logging in to the system, posting on a forum and accessing a reading material page. The amount of XP allocated varies by action, depending on how much effort is required. For example, students who post on the forum earn more XP than just logging into the system.

Levels. In video games, levels are often defined by missions or stories. Once you complete one, you get access to the next, harder story. Curiosity and the desire to achieve or conquer make levels motivating. At Moodle, students' progress through different levels of learning as they complete content and courses. Levels can vary in changing different themes, colors, or images. Earning a certain number of experience points (XP), students move to a new level, and thus gain certain experience and

knowledge. It is possible to use a linear or exponential algorithm to dynamically calculate the levels based on the XP required to arrive at them.

Dashboard. Dashboard is a customizable page that provides users with details about their progress and upcoming deadlines. At the center is a course overview block that allows students and teachers to easily track required activities and filter courses. In order to show a visual representation of how students in a particular endeavor are ranked relative to other participants, dashboards with the best results are used, where those with the most XP were ranked the highest, i.e. at the top of the scale. This allows students to check their progress and performance by comparing them to others.

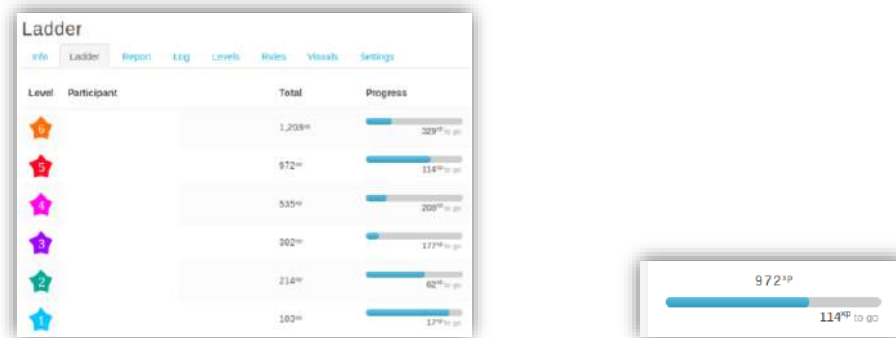


Figure 4 Dashboard and Progress bar

Progress bar. Due to the fact that providing feedback to students can greatly improve their learning, it is possible to use progress bars as a tool to show how far a student is from reaching the next level.

Teams. Teams are realized through groups in Moodle, which gives the opportunity for cooperative work of some students. For different learning activities, different groups can be organized. Cooperative work is very important because it helps in building social skills.

Stash. The hidden block is a good way to encourage more interaction with activities and is invaluable for teachers who want to gamify their course. This appendix introduces a block that shows students the items they picked up during the course. The teacher can create subjects and then place them in activities and resources that students can find. Subjects can be set up by collecting them once and encouraging research on course material.

Motivated. Users earn virtual coins and can spend it to update their avatar and upload it to their Moodle page. The generated content allows students to create parts of a digital avatar and transfer them to a mobile application.



Figure 5 Stash and Mootivated

In the implementation phase, after selecting add-ons for Moodle, they need to be installed so that we can customize and use them.

The final phase (evaluation phase) actually determines the difference between the achieved results and the set goals in the planning phase. So we value the learning outcomes, but also the system itself. In order to assess students' satisfaction (as a subjective perception) using Moodle with gamification and student engagement in an e-learning course self-assessment tests can be set. Also, repeatable tasks can be set to encourage students to increase their knowledge and skills through repetition and gain more points and badges. Obtaining a badge means that the student has achieved all the learning goals for this level.

4. Educational Apps That Use Gamification

To motivate a person to achieve their best performance, games can be designed to interactively increase the difficulty of an activity to match the player's growth in skill (Barata et al., 2015; Garris et al., 2002; Malone & Lepper, 1987). Ensuring the right level of challenge can, however, be difficult depending on the goal of an educational or serious game. In the current study, the goal of the app is knowledge acquisition-letting students learn a list of facts.

In the following discussion, some applications for creating interactive lessons, quizzes, crossword puzzles, mind maps, etc. are presented.

4.1. Duolingo

Duolingo is one of the most notable examples when it comes to gamification in learning apps. This language application offers a solid set of game-based elements, which helps keep the learning process fun and engaging. Social learning features contribute to the success of Duolingo. A notable gamification element of Duolingo is its main character, the eponymous owl Duo. The mascot guides users through the app, making it easier to navigate and more fun to use. Duolingo is one of the best language learning apps for getting acquainted with a new language or improving your existing skills. It has wonderful exercises and a clear interface, and it works well on both desktop and mobile devices. Key gamification features: experience points, badges, leaderboards, achievement levels, rewards, virtual currency, storylines, personalization.

4.2. SoloLearn

SoloLearn is one of the learning gamification apps in software development. The platform offers challenges where users can compete and win experience points. There's also a Code Playground with a leaderboard where learners can showcase their code and get feedback from other users. The platform has great social learning features. The app's community is gamified, and learners can even use the apps created by each other. In the Q&A section, users can upvote topics and earn points for replying to questions. Key gamification features: experience points, badges, leaderboards, achievement levels, rewards, virtual currency, personalization.

4.3. Socrative

One of the most popular game based classroom platforms is Socrative. Socrative is a powerful tool that offers professors many opportunities, such as fun, effective engagement, and assessment on the go. It is one of the most versatile and customizable platforms, offering three different highly customizable modes: a typical question-based game mode, a mode called "Space Race" that aims to combine accuracy and speed, and a third mode called "Exit Ticket". Exit tickets are an effective way to gather end-of-class feedback, giving students an opportunity to demonstrate what they've learned and for teachers to be sure that all teaching objectives were met. Socrative supports multiple choice, true / false and open answer items. This allows teachers to tailor their teaching based on feedback. It can work just as well as a web-based tool as a mobile app. Key gamification features: levels and scores, progress bars, leaderboards, rewards and badges, personalization.

4.4. Kahoot!

Kahoot! is the first Student Response System (SRS) designed to provide a game experience by implementing game principles from the theory of motivation and gameplay. Kahoot! transforming classroom learning into game performance by way of the lecturer giving questions from the laptop, displayed on the class screen, and students answering with his mobile phone device. Kahoot! uses audio, image, and video assistance on the SRS to help the student learning process. Almost all students feel motivated when using Kahoot! and have increased their performance. Compared to similar platforms that focus on SRS, such as Quizizz and Google Form, Kahoot! has a more significant influence on participant concentration, perceived learning, enjoyment, engagement, and satisfaction than other platforms. According to, Kahoot! can test students' early understanding and student motivation based on data in the early session of delivering material. Moreover, according to, Kahoot! can also reflect or evaluate student understanding at the end of delivering material based on specific information and instructions. Lecturers can easily use Kahoot! to display answers with pictures, videos, and sounds, the lecturer can also see the number of active participants and the test results. Key gamification features experience points, badges, leaderboards, achievement levels, rewards, personalization, ranking through the podium, encouraging competition, and using time limits for student achievement.

4.5. Khan Academy

Khan Academy is a learning platform for acquiring academic skills. The main mission of the platform creators is to make education accessible, so users can study subjects like science, math, history, and more completely for free. To make such courses easier to comprehend, Khan Academy provides several gamification features: experience points, badges, achievement levels, progress dashboard, personalization. The badges and achievements are split into categories based on the course complexity level. The badges and avatars are astronomy-themed, which adds the personalization element to the platform. Khan Academy also features a skill tree, where the subjects are neatly organized for users to see their learning paths.

4.6. Codecademy

Codecademy is an American online interactive platform that offers free coding classes in 12 different programming languages including Python (pandas-Python library, Beautiful Soup-Python Library), Java, Go, JavaScript (jQuery, AngularJS, React.js), Ruby (Ruby on Rails-Ruby framework), SQL, C++, C#, Swift, and Sass, as well as markup languages HTML and CSS. Codecademy students love it because it is accessible to beginners and gradually introduces them to the programming language. It is also highly valued for the gamification of the system. It offers a variety of badges and achievements and the more lessons users complete, the more badges they will receive. Although you can find various topics on it, from the simplest HTML and CSS to the creation of complicated server systems, it is intended mainly for absolute beginners. Key gamification features: experience points, badges, leaderboards, achievement levels, rewards, personalization.

Getting students excited about learning is easier than ever with the help of technology and gamification. By using these techniques and apps, you can make your classroom wonderfully interactive. Of course, always remember to reward students for their efforts to keep them motivated and capture their imagination.

5. Conclusion

The main purpose of gamification is to combine learning with fun. By implementing gamification in online learning systems, we get not only systems that motivate students to learn, but also make the whole process much more interesting.

Content, learning, tests, results, become much more interesting by applying gamification in the Moodle platform. The elements of gamification are numerous and their implementation increases the interest and motivation, and thus the success of students in mastering the curriculum.

Today, there is a large number of educational applications that use gamification in creating interactive lessons, quizzes, crossword puzzles, mind maps, etc. This paper presented some applications that successfully complement the traditional way of learning and make learning fun.

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WHAT IS OUR JOB NOW? ENGLISH TEACHERS' ROLES IN A PLURILINGUAL AND INTERCULTURAL EDUCATIONAL SYSTEM MODEL FOR A MULTILINGUAL WORLD

Cerveró-Carrascosa, Abraham

Florida Universitària, València, Spain

acervero@florida-uni.es

Serrador-Almudéver, Raül

La Nostra Escola Comarcal, València, Spain

raul.serrador@uv.es

Abstract. The present paper deals with the roles and challenges that English language (EL) teachers have to face in the Valencian educational system. Territorial regulations in València promote English as a medium of instruction (EMI) in non-linguistic subjects in different educational stages. The law also advocates for CLIL as the teaching approach to be promoted in EMI classes. English language practitioners find themselves in a crossroad in which their classes are not the only input in English for students and, at the same time, they often are the best-suited teaching staff to carry out the demands set by local authorities.

The revision of different aspects related multilingual proposals are exposed after a literature review. On the one hand, different methodological implications for teachers' practice are explored: the roles of literature and grammar in EL classes and the development of the intercultural communicative competence (ICC). On the other hand, some other frequently neglected aspects of their duties are also tackled, for instance, their involvement and commitment to international activities, their support to CLIL teachers...

Several suggestions on the design and the content of EL classes are outlined: the role of the metalinguistic awareness in the quality of language output, how literature can enhance language proficiency and the actions to foster the intercultural communicative competence in multilingual education.

Key words: *Intercultural competence, ELT, multilingual policies, English as a Lingua Franca (ELF), English as a Foreign Language*

1. Introduction

The Spanish law allows each region to set their own different regulations with respect to education. It could be stated that there is a Valencian educational system. With regards to the Valencian territory in Spain, two languages coexist: Valencian, as this is the name by which Catalan is named and Spanish as it is the official language of the country. The policies that have guided the organisation and teaching of languages followed the regulations issued by the local authorities when Valencian started to be the medium of instruction in our primary and secondary schools (Generalitat Valenciana, 1983).

The last Plurilingual law is the fourth milestone for the multilingual policies to be followed was enacted in February 2018 and establishes the already coexistence of both languages and the primacy of English as the first foreign language to be learned plus another second foreign language, Romanic preferably. That is why the amount of hours of instruction in English has increased in all educational stages: in Primary and Secondary Education, the amount of time to be delivered in English must be 15% to 25% whereas in postsecondary (sixth-form) education and vocational training courses it may range from 10% to 25%. It altogether means that in every Valencian school, English as a subject (3h/week) plus another non-linguistic area (2h/week). In the latter case, when English is the language of instruction, the authorities recommend Content and Language Integrated Learning (CLIL) as the approach to be observed. Moreover, it is compulsory for every school to state the actions to be undertaken to promote the development of intercultural competence (Generalitat Valenciana, 2018). Thus, primary and secondary schools have had to adapt their practices to the situation. The Covid-19 pandemic has inflicted a delay in the actual implementation of the whole scheme, however, all these educational institutions have already caught up and elaborated their models of PEPLs that stands for plurilingual and intercultural teaching programme in Valencian Catalan.

Bearing in mind this particular educational setting as far as multilingual policies are concerned (Baldaquí & Pascual, 2021), this paper aims to offer EFL teachers and any other practitioners, school administrators, additional views on their roles and duties in a plurilingual and intercultural system for a multilingual world.

This paper constitutes a literature overview on what entails to teach English from an EFL to ELF (English as a Lingua Franca) conceptualisation will occupy the first place. Some suggestions on the functions of metalinguistic awareness when it comes to language production and, particularly, a revision of how teachers may develop the acquisition of the intercultural communicative competence.

2. English Language Teaching: from an EFL to ELF paradigm

Multilinguals contexts are said to be predominant in the whole world. In those settings, languages, communities of speakers live together and, in some of them, English is used as a lingua franca or the language used by those communities to relate to each other, these are the expanding circle territories as Kachru (1986) identified them.

The majority of countries in the world have adopted English as the foreign language in their educational systems. Since it has reached this status, it is known as the only language whose amount of native speakers are fewer than those who employ it or learn it on a regular basis (Llurda, 2020). Therefore, the hegemonic trend to adopt the features of the native speakers or themselves as the main core of English courses' syllabuses is being ousted by a movement that advocates for a decolonisation of English (Finardi, 2019) and debunk the myth of the "native-speakerism" as the reference for English Language Teaching (ELT) and English as Medium of Instructions (EMI) practitioners.

The Valencian educational system has as main objective of education to prepare students to interact not only with native speakers but to use English as the international language of communication. It entails to understand learners as multicompetent users of a language (Portolés, 2020). The competence gained in a language enables the use of different cognitive and metacognitive strategies allow learners to transfer them when

using different languages. In other words, developing learners' proficiency in a foreign in the educational systems starts is supported by the experiences in other languages in all the non-linguistic subjects concerned (Pascual, 2016). This is a policy supported by the Council of Europe and pedagogically arranged by the Graz group (Coyle & Meyer, 2021).

There is still, at least, one issue to be faced: most teachers have received their training in territories where English is the L1 and can identify themselves, in a way or another, with English L1 (EL1) communities or use them as linguistic and cultural models. It altogether may turn out to be challenging to embrace a new concept. Furthermore, a change in this paradigm can also mean a more comprehensive, inclusive and ecological version of language teaching. There should not be a preference of a variety of English as the genuine one which may empower decolonization and support views on equality in the status of all languages, the official ones by law and those ones present at school that may well be *invisibilised*, like heritage languages (Juan-Garau, 2020).

All in all, it seems crucial to make this distinction and keep a further discussion within schools, not only for English teachers but also school administrators and those qualified non-linguistic-area teachers who may end up delivering subjects in English.

3. English teachers and metalinguistic awareness

Since the communicative language teaching (CLT) approach emerged, the focus of foreign language pedagogy has been set on communication. Llorca (2020) does also support that in EMI classes the attention must be put in and meaning negotiation. However, formal features of the language are part of the curriculum even if broader and far-reaching tactics are used by embracing an ELF view. Even so, there is still a question to be tackled that demands further reflection, whose models or criteria must teachers use to design their materials?

Llorca (2020) suggests emphasising some pronunciation or grammar features over others, particularly to decentre or decolonise speech. Even though such recommendation tries not to create a new ELF standard, it may not be realistic, as L1 forms should not be banished.

Getting back to the inclusion of some kind of metalinguistic reflection, it must be pointed out that even in the epitome of a focus-on-meaning teaching method, Task-Based Language Teaching (TBLT), the reflection on formal aspects of the language is still present (Lorenzo et al., 2011).

Grammar and language conventions, such as spelling and punctuation, are an indispensable part of the construction of texts (either oral or written) that, in turn, are the core of academic instruction. It may well be agreed that in levels of lower proficiency, this is an aspect of language learning to be overlooked. Higher proficiency levels can benefit from a regular grammar practice, besides, there is evidence that grammar proficiency can be a predictor of producing higher quality texts (Hyland, 2003) and those features can be learnt across languages if a multicompetence philosophy is taken up (Cenoz & Gorter, 2020).

The inclusion of literary forms can also spark up the reflection on different formal aspects of the written language as further developed in the next section.

4. English teachers and the use of literature

An often neglected content in the English curricula is the use of literature. If some of the genres to be learnt by students in primary and, particularly, secondary and post-secondary education (including vocational training) in EMI or CLIL (as it is the case of València according to general recommendation) subjects, not necessarily in the English class, the use of literature in English becomes a priority (Almeida et al., 2020). First of all, literature will serve as a contextualised example for metalinguistic awareness. Teachers can recur to literary texts to improve students' vocabulary and instances of grammar forms that are used meaningfully (Piantanida, 2020; Puig, 2020). Second, texts can provide a background for reflection of the different representations of worldviews. Thus, it will promote the acquisition of the ICC and can make voices from beyond the inner circle visible. However, its use has been perceived as difficult to be handled in class despite "the attractiveness and effectiveness of literature in terms of increasing motivation and enhancing language skills" (Puig, 2020, p. 15).

It is also true that in both cases, we also suggest including these literary texts in agreement with the teachers of other subjects. In L1 and L2 (may that be Spanish or Valencia-Catalan in València), it may foster a broader, transnational vision over literature and enforce the readers' programme that every school has to design for their students (Piantanida, 2020). Moreover, even if it seems further from their duties, teachers from non-linguistic areas and CLIL teachers should also be part of the inclusion of literature as part of the integration of language in their learning routines (Pascual, 2016). It should be implemented gradually as in lower proficiency levels it may be difficult to take advantage of, nevertheless, higher levels can benefit from the aspects mentioned above.

5. English teachers as a multilingual learners and intercultural facilitators

5.1. Affective dimension

In multilingual contexts such as the Valencian one, the foreign language teacher as a multilingual learner might be interculturally competent and bear in mind the affective dimension in foreign language learning. In this regard, in the field of second/foreign language acquisition, authors such as Kramsch, Dewaele or MacIntyre claimed that emotions stimulate the language learning process. Positive and negative emotions, which are embedded in the interactions between learners and teachers and fluctuate over different periods of time. Dewaele (2013) highlighted some of the emotions in learners such as enjoyment, anxiety, flow, love, shame or emotional intelligence management and their importance of emotions in the teachers sphere and underscored the relevance of emotional management and motivation.

Regarding the role of the teacher, Underhill supported the model of the "facilitator" teacher, who, should master the contents of the subject and its teaching principles well and should be able to generate a psychological atmosphere which would turn out into an optimal learning process (Underhill, 2000). Along these lines, Zull (2002) argued that education is "the art of changing the brain", and justified that "to change the brains of FL learners you must first connect with their brains". He remarked that it is important to consider that the learners need to feel comfortable, therefore, the teacher should try to reduce their anxiety, boost their confidence and self-esteem and create a good

group dynamic in the classroom. Furthermore, it is pointed out that the learner needs to be interested in what he/she is doing through activities that motivate him/her and give him/her personal meaning.

Dörnyei and Malderez (2000) recommended dedicating time to group processes and carry out activities which, while developing language skills, also are useful to 'break the ice' and foster relationships within the group. In a similar fashion, Rodríguez and Kearney's (1996) teaching model show that if teachers create an affective relationship that supports students through proximity and friendship, students are predisposed to spend more time on learning tasks and therefore achieve better cognitive outcomes in the classroom. In this line, Dewaele (2020, p. 5) conceded that "the teacher plays a crucial role in positive emotions and only marginally in negative ones", he added that there is an emotional contagion in both directions, and some of the learners' emotions influence the teachers' emotions.

5.2. Intercultural Dimension

The role of the teacher is not only crucial in the affective dimension of the FL learner, but also in intercultural education as a whole. Byram, M., Nichols, A. & Stevens, D. (2001) argue that education and educators have a special role to play in the field of FL learning, a context in which encounters between social groups (ethnic and national) speaking other languages are more plausible. Teaching the intercultural dimension involves taking advantage of intercultural encounters and being systematic in developing them, e.g. by using theory as an aid and evaluating the results with clear and explicit criteria. These opportunities come from specific situations that sometimes involve classroom work in a face-to-face or distance manner, with the help of technology or with real material. Therefore, experience is not enough, but perhaps a necessary condition for interculturality.

Byram et al. (2001) suggest that the main aim of teaching and learning the intercultural dimension is not the transmission of information about the foreign country, but to help learners to know how intercultural interaction takes place. Moreover, it should focus on how social identities are part of all interaction, how their perceptions of other people and other people's perceptions of them influence communicative success; and how they can discover, for themselves, more about the people they are communicating with. If an ELF approach is embraced, a wider room for this reflection could be part of the English classes and could be applied to the rest of the languages taught in the schools at all educational levels.

The teacher should design activities that enable learners to discuss and draw conclusions from their own experience of the target culture/s as a result of what they have seen, heard or read. They should provide real information related to the lifestyles of the target culture and the patterns usually followed by members of this culture. Most importantly, however, the teacher should encourage the learner to make comparative analysis between the target culture and their own culture, and to think about whether their perception of the foreign territories will be the same as that of the inhabitants themselves. In order to carry out these actions, learners can engage in communicative simulations and role-plays that activate their knowledge and preconceived schemas of other countries and cultures. The teacher should also encourage learners to be more observant, to notice details of cultural behaviour and to report what they observe using

a diary or logbook, to act as ethnographers. With these experiences, learners can leave much better prepared to communicate with other intercultural speakers, to tolerate differences and to cope better with the everyday situations they will encounter in the foreign country. Teachers should encourage students to be able to explain the students' worldview to people from a different one and explain the local community/ies some other people's representation of the world (Corbett, 2003).

In this type of work there is no need for the teacher to be an expert in knowledge of the other countries, the main objective is to know how learners 'respond to others', how others perceive them and how to interact with people from other cultures. Of course, there is factual information that learners need to know about the other countries where the target language is spoken, but this is available in reference books, specialised publications or on the Internet. This kind of information does not depend on having been to the countries in question; indeed, when someone visits another country such information is not to be found.

Teachers who are more aware of the cultural dimension of language learning place greater emphasis on developing the nature of their learners' cultural interaction, and on the skills and competences that enable them to distinguish cultural differences. In the final analysis, even teachers who have not personally experienced a particular society - or even lived with people with different social identities in that society - can help their learners to engage with texts and documents in which those identities are expressed. Their role, as teachers, "is to enable learners to inquire into the cultural beliefs, values and practices involved" (Byram & Fleming, 2001, p. 9).

Following these ideas, Wessling (1999) argued that the teacher must help learners to ask questions and to know how to interpret answers. FL teachers have the opportunity - and the obligation - to teach a language, but also to equip learners with the tools to understand members of another culture, to understand the other and what is foreign to the learner. One must teach and learn how to deal with the other reality.

Deardorff (2011), on the other hand, raised questions about how teachers should provide learners with some room for reflection on the development of their own intercultural competence. For her, it is the duty of educators in general, and FL teachers in particular, to see how they can apply methods and theories to the development of the process of intercultural competence. Reflection is an important part of this process and from these other questions should be raised such as:

- what perspectives of intercultural competence exist from different countries;
- how interculturally competent educators are;
- how to increase the development of the educator in this area;
- how the assessment of intercultural competence in the LE classes will be oriented as essential learning;
- how the process of developing intercultural competence can be integrated into the curriculum.

It is necessary to build relationships with other cultural backgrounds, as language alone is not enough to know about day-to-day intercultural interaction.

In this sense, for years, new approaches to language learning and teaching have prioritised the model of the intercultural speaker over the hegemonic model of the native speaker (Byram, 1997; Kramsch, 1998). According to Holec (1980), the

intercultural speaker is someone who is learning to be independent of the teacher and the limits of what he or she can achieve in the classroom. The process of intercultural learning can take place, at any age of the learner, in formal education or in the workplace. In addition, it is not an entirely complete process, as teachers and researchers continue to learn and develop their skills as intercultural speakers. In FL classes, where there is no significant cultural diversity, learners who learn with the intercultural speaker model do not follow a pattern that departs from their culture and imitates the native speaker model in an (often) artificial way.

Thus, in the intercultural dimension of LE learning, the learner must recognise his or her identity and be aware of the existence of other identities. The intercultural speaker's position of advantage must be accompanied by a growing sense of personal and individual responsibility for the use of words and their meanings. In the intercultural approach, the most effective learner is not the one who imitates the native speaker, but the one who is aware of his or her own identities and cultures, how others perceive them, as well as the identities and cultures of the people with whom he or she interacts. Hence, language teaching that respects the intercultural dimension should include, in addition to the traditional objective of acquiring the linguistic competence necessary to use the language in any oral or written communication according to the established codes, a second, more novel objective: to develop intercultural competence in the learner (Paricio, 2004, p. 6).

Byram, M., Gribkova, B. & Starkey, H. (2002) pointed out that the teacher's main aim in teaching the intercultural dimension of FL is not only to transmit information about a foreign country or culture, but also to guide students in the learning process. In recent studies about students' exchange programmes and intercultural competence development in face-to-face encounters (Serrador-Almudéver, 2022), virtual exchanges (Dooly & Vinagre, 2021; Orsini-Jones et al., 2021) or hybrid (Orsini-Jones et al., 2019), we found that along those holistic and global task-based projects the teacher provides students with the necessary resources to develop their intercultural competence through tasks included in their programmes. Activities such as 'getting to know each' other dynamics, matching writings, exchanging information, 'discovering the other' and the like are implemented in and out the classroom.

6. Final remarks

There is an ongoing shift in the consideration of the approach on what to teach in EMI education as Llurda (2020) remarked. From EFL to ELF, the selection of contents and models for language practice and communication can move towards a decolonised view of English and the inclusion of instances of use from the outer and expanding circle (Kachru, 1986). This, at the same time, can lead to a conflict with CLIL subject teachers whose beliefs still lie in the inner circle territories' world views and native-speakerism as the preferred models.

The improvement of metalinguistic awareness should also be part of the job. It does not mean to be grammar teachers or adopt just a focus-on-form approach. It entails being part of a team to enhance the accurate use of formal aspects. Such reflection should start after a certain proficiency level has been reached. It would be a suggestion once instruction is based on "can do" aspects from level B or C according to the CERF. Cooperation with CLIL teachers, in this case, is essential to gain insights of those forms

that are the core of the English and CLIL classes. It is also necessary to extend this cooperation on how and when the different formal aspects are covered. Moreover, a higher level of grammar proficiency can act as a predictor of high quality text production.

Literature can be part of the solution concerning the rise of metalinguistic awareness. Literary texts can complement the different genres to be produced by students in the CLIL subjects, particularly, in secondary and post-secondary education and vocational training. Literature can also foster reading comprehension activities as well as promote student's intercultural communicative competence, as it can be the base to enhance the knowledge of the world of learners and can be used as a tool to put into practice the skills to check on their attitudes towards certain aspects of the target culture/s.

English teachers should also contribute in the design of interdisciplinary learning experiences and foster cooperative learning in their classes. Exchanges can foster the ICC, especially if they are to be with international participants. Nowadays, students' exchanges, either face-to-face or virtual, have become holistic and global projects that influence the development of that ICC (Orsini-Jones & Lee, 2018).

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AUTHENTIC MATERIALS IN FOREIGN LANGUAGE TEACHING

Katarina Krnić

University Department of Professional Studies, University of Split, Croatia
katarina.krnic@oss.unist.hr

Petra Grgičević Bakarić

University Department of Professional Studies, University of Split, Croatia
pgrgicev@oss.unist.hr

Abstract. This paper underlines the importance of a frequent introduction and consideration of both linguistic and culturally defined elements in the everyday Italian and English language classroom. The culturally determined component is often inadequately represented and insufficiently highlighted in language course books due to lack of their culture-related contents. Its ignorance, however, may frequently result in misinterpretations of culturally specific contexts or even unsuccessful communication with native speakers. The authors advocate for a more regular use of carefully selected authentic materials, such as audio, visual, and audio-visual materials within modern language instruction, placing special emphasis on a photograph as a valuable visual aid and a television show as a distinctive audio-visual aid. A more frequent exposure of students to these should subsequently enhance students' cultural awareness and, thus, pave the way for tolerance and effective communication. This is discussed in the introductory part of the paper. The main part of the paper revolves around the didactic role of a photograph in the Italian language classroom and a television show in the English language classroom aimed at boosting students' linguistic and cultural competence. These could serve as an example of how other materials belonging to the groups introduced could also be aptly employed in an identical or an equivalent way in foreign language teaching.

After a brief insight into the notion of a photograph, the criteria for its selection are analysed. Then, the variety of related activities that may be used to foster the grammar and vocabulary acquisition are presented. Cultural elements are also discussed and delineated. An introduction into the notion of a television show, particularly the American television show *Orange is the New Black*, is followed by the coverage of the objectives set and the criteria used for its selection. The subsequent didactic analysis of its representative parts targets some of its major educational, linguistic, and cultural aspects. The discourse encountered displays both linguistic and cultural abundance. Its underpinning sociocultural context presumes usage of a variety of idiomatic expressions, phrases, and underlying behavioural patterns.

Key words: *language, culture, authentic materials, selection criteria, analysis.*

1. Introduction

Amidst a current rapid technological development, the educational field and foreign language teaching and learning (FLT) particularly have been provided with a new indispensable track to follow and an opportunity for embarking on their large-scale transformation process. Computer-assisted language learning (CALL) as a source of movie-assisted FLT, computer and audio-visual equipped classes, apps, chat, TV comprise just a few recognized examples of application of technology in FLT providing language students with access to authentic language input. According to Taylor (1994), authentic language material refers to any language material that has arisen from real

communication and has not been designed for language teaching. Despite the currently existing disagreement in the field of language acquisition as to the scope of the role assigned to authentic language input (Ellis 2008), there has been overall agreement on the fact that an amount of comprehensible language input is required for FLA to occur. This has prompted the introduction of new methods of language instruction involving authentic language input and aiming at ways of language development and improvement accompanying traditional instruction. Therefore, a variety of audio, audio-visual and visual authentic materials have been widely used in FTL over the last few decades. This has resulted in a significant increase in the design and use of engaging teaching activities ensuring students themselves significantly benefit from learning languages both in-and-outside the classroom settings. Audio-visual materials employed comprise a wide array of TV and internet-related contents: a balanced and suitable blend of picture, sound and script sets the scene for a completely natural everyday language situation displaying various verbal and non-verbal reactions of native speakers. Effectively synthesizing linguistically and culturally relevant data and drawing on its appeal and suggestiveness a TV film/show acts a valuable audio-visual aid. Visual teaching materials exhibit a concrete material resulting from objective reality: drawings, pictures, posters, maps, tables, photographs. This paper provides accounts of the didactic roles assigned to a photograph in the Italian language classroom and a television show in the English language classroom. Both aim at increasing students' motivation and engagement in learning the respective languages, boosting their linguistic competence, skills, cultural awareness, and enhancing their critical thinking skills. These could also serve as an example of how other materials belonging to the groups introduced, e.g., quiz, video clips, could also be aptly utilized in an identical or an equivalent way in FLT.

2. Photograph

Photography is a technique of recording digitally or in a chemical way a scene from reality on a layer of light-sensitive material falling on it. The first colour film, Kodachrome, went into mass production in 1935, but it was not until the last decades of the last century that it became popular among amateurs and professionals.

Digital photography, which has been available for the last three decades, does not use film, but "sees" the image through an electronic sensor as a set of binary data. This allows you to save and edit images on a personal computer. The advantages of a digital camera are manifold: by reviewing the shots on the spot, the photographer can easily spot and correct mistakes, erase the bad ones and save only the successful ones. In addition, photos on a computer can be processed and enhanced; sharpen, control contrast, light, colour intensity, etc. (Kelby, 2007). This branch of art has interested many creative individuals. In the constant pursuit of perfection, photographers eventually cease to be satisfied with simple portraits and a documentary approach to photograph. Thus, inspired by painting, they begin a new kind of art - art photograph. Using the capabilities of the camera and his own skill, the photographer can turn a seemingly lifeless shot into a work of art comparable to the works of great experts in painting and sculpture. This could be adjusted and aptly used in various educational fields, particularly FLT.

2.1. Selection criteria

The use of photograph in foreign language teaching is didactically justified only if the content fully corresponds to the language competence, age, and interests of those for whom it is intended, and if its application achieves the planned teaching goals. Thus, students of elementary language skills will be suitable for unambiguous photographic motifs that encourage the use of specific vocabulary and simple grammatical and lexical structures. On the other hand, proficient students will prefer complex motives leading to more complex grammatical structures, abstract vocabulary, unusual stylistic figures and presenting a challenge that calls for open discussion.

The latest models of laptops, mobile phones and/or cars will arouse the curiosity of teenage students, while the youngest ones will enjoy the scenes of their favourite toys and/or sweets.

At no time should a teacher neglect the interests and preferences of students by clinging exclusively to those contents that are thematically closer to them. Thus, students of Tourism will be particularly challenged by photographs of individual tourist destinations, content, or agencies, while art history lovers will find inspiring scenes of churches, squares, fountains.

A teacher who decides to apply numerous didactic possibilities of using a photograph in teaching must have clearly defined goals. These goals must be in line with sets of teaching activities aimed at enhancing students' either grammatical or lexical knowledge. It should be emphasized that receptive and productive language skills can be practiced equally successfully by applying appropriate, expertly selected photographic content. The listed criteria highlight the importance of the correct choice of photograph for teaching purposes. Incorrect choice of any teaching aid in relation to a specific teaching task and its inconsistency with students' language knowledge can cause discomfort and repulsion in those for whom it is intended, which leads to slowing down and/or misdirection of the learning process.

As we peek into the world of colourful photographs, we will list an array of possibilities of its application in FLT.

2.2. Work on the selected photo

2.2.1. Work on the selected photo in the introductory part of the lesson

At the very beginning of the class, it is desirable to completely free students from anxiety, discomfort, and fear of a new, infrequently used medium in the classroom and create a relaxed and pleasant working atmosphere. It is possible to familiarize students with the desired content through unambiguous, suggestive, oral questions that make them the protagonists of the story they are just embarking on, and spark off their curiosity needed for acquisition of new content (*Do you like to take photos? What motives particularly appeal to you? Why?*). It is advisable to provide them with useful information about the selected photograph, who filmed it, where, when and under what circumstances, what makes it interesting, etc. The aim of this introductory part of the lesson is to "warm up" students for the teaching activity that follows.

Teachers may choose to present the desired photo to the whole class at the same time, but they may also decide on to presenting it to only half of the students, asking them to remember as many details as possible in a given time. They then orally present everything they remember to those students who have not seen the photo. Guided by their description, they individually form drawings. Since students are expected to use

the language in a longer monologue, it is advisable to record and explain mistakes that are common in speech production. The attention focuses on the communication goals of the speech act, and any interruption would disrupt the concentration of students and thus affect the fluency of their speech. Finally, the teacher shows the photo to all the students inviting them to compare their own drawing with the original photo.

2.2.2. Work on grammatical elements of language

The photographs also proved to be didactically justified for practicing the grammatical elements of the language. Descriptions of a photograph and potential dialogues or conversations among its protagonists can become a template for creating various exercises based on substitution, transformation, synthesis, text supplementation, multiple choice, etc. All these are cognitive exercises that activate the student's knowledge of language, encourage him/her to think about the rules of use and their application. At the same time, it is extremely important to consider the linguistic progression of students. In this way, well-known types of exercises are presented in a slightly altered way and thus could be perceived as fertile ground for strengthening students' grammatical competence.

2.2.3. Work on lexical elements of language

Guided by the basic theme of photograph, the teacher can be the author of well-designed exercises aimed at lexical and morphosyntactic upgrading of language. They can be conceived differently; after a two-minute observation of the selected photograph, students may be asked to present all the words they can think of that are directly or indirectly related to the photograph just seen. Students may be invited to place these words in appropriate categories (e.g., a photograph of a typical Italian family at the kitchen table; *cibo, arredamento, posate*). Equally, it is possible to ask them to connect certain words or expressions with the corresponding definitions or pictures (e.g., a photo of a typical student desk; *scrivania, mensola, dispensa*). Furthermore, students may be faced with the not-so-simple challenge of supplementing an incomplete text. It is about the so-called close test, and particularly intriguing was the design of a dialogue between the protagonists of photograph (e.g., photograph of a typical Italian market; dialogue between seller and buyer). These are authentic dialogues presented in a situational context from everyday life. Instead of words in Italian, students can be given their equivalents in Croatian, for each omitted word it is possible to specify the first letter or suggest a choice of several words, only one of which corresponds to the linguistic context. Equally, students, relying on their own imagination, can approach the independent design of the whole text. Photographic motifs (people, objects, actions) can be an excellent incentive for a systematic sequence of all adjectives that can be used to characterize selected motifs (e.g., a photograph of a tourist on one of the Venetian bridges; *which adjectives most faithfully depict the facial expressions of these tourists?*). The variety in the use of adjectives can be extended by asking them to list the corresponding nouns, synonyms and/or antonyms. Considering the lexical progression, the teacher can invite the students to complete the started, photograph-inspired thought (e.g., a photograph of two young lovers: *per me l'amore è...*). The abundance of denotative and connotative meanings of the Italian lexical system is especially emphasized in its plentiful metaphorical expressions (e.g., a photo of a typical hair salon: *avere un diavolo per capello, averne*

fin sopra i capelli, a photograph of two young lovers: *prendersi una bella cotta, fare le corna...*). Metaphor selection should be guided by the criterion of its frequency in the spoken language. Students, using a monolingual dictionary, can search for other expressions that contain a given word (e.g., *capelli*, *corna*).

In FLT, it is necessary to emphasize the importance of the situational context in interpreting the meaning of words, for their respective comprehension and passive reception. A prerequisite for expansion the existing vocabulary can also be acquainting students with the meanings of individual suffixes and prefixes for word formation. A useful exercise is to convert one type of word into another using suffixes and prefixes. Practicing word associations by similarity is possible by selecting related words by meaning from a larger group of unknown words, selecting words from multiple choices according to the given context, determining words based on their description or definition, etc. Designed translation exercises can intentionally mislead students to make mistakes in order to exemplify the difference between their native language and a foreign one. Through such and similar exercises, students' intellectual curiosity is kept constantly awake, which is a prerequisite for building a positive attitude towards the content of learning.

Training students for speech competence is considered a priority task of teaching foreign languages. The distinct suggestiveness of photograph makes it suitable for conducting a variety of speaking activities. They can be divided in two categories: language and communication oriented. Often based on mechanical repetition, linguistic activities tend to appeal less to students. On the other hand, there are those speech activities that strive to achieve the communicative goal of students, while not properly observing linguistic accuracy of statements. Consequently, the teacher's direct intervention is missing. Depending on the needs of the teaching moment, the teacher will adhere to one or another group of speaking exercises, and it is worth noting that both types are equally needed in FLT.

The actions or situations shown in the photograph can become a source of misunderstanding. Each student will interpret the content seen in their own, subjective way and will notice details that may be irrelevant compared to those expected by the teacher. Therefore, it is necessary to reconcile the students' ideas about what the illustrated situation really shows in a short conversation, in students' native language. The success of speaking activities depends on the readiness of teachers. The teacher, by asking unambiguous questions, encourages as much variety as possible in answers (e.g., *Find a suitable title for the photo and explain the reasons; In your opinion, who is its author? Where was the photo taken and under what circumstances?*). Students' attention can also be focused on the details they want to comment on; age, clothes of the protagonist, features of the interior or exterior, etc.

The picturesqueness of photograph can be further expanded through questions about their predictions about the preceding and succeeding contents. It is particularly important that the selected content is sufficiently inspiring and thematically close to the students (e.g., a photo of a student in front of the Faculty of Foreigners in Perugia). This type of exercise encourages students to be independent in presenting their own assumptions, which creates the conditions necessary for the development of particularly important but often-neglected creative thinking.

With proficient students it is possible to discuss the characteristics of photograph, the role of colour, shooting angles, depth of field, play of light and shadow and provoke a desire for oral expression (e.g., *What do you think about the advantages and disadvantages of digital photograph? Do you appreciate art photograph?*). With this bold speaking activity, students practice the productive skill of free expression.

Communication speech exercises whose imagined conversation entirely relies on protagonists from the photo proved to be extremely well received. It is advisable to provide students with vocabulary and language structures that they will be able to apply in speech. By transposing the given linguistic material into a diverse situational context, students develop creativity and gain insight into the expressive richness of language. It is especially important that the roles envisaged are adapted to their general knowledge and experience. The possibility of identifying with the depicted action or the protagonist helps them to weave elements of their own experience into most of the fictional content of the story (e.g., photos of cheerful Juventus fans in front of the stadium in Florence). The naturalness of the role-play exercises successfully removes the artificial classroom atmosphere. It is important to keep in mind that the success of this type of oral task depends not only on the students' language skills but also on their character traits. Experience has shown that an imaginative and eloquent individual will surely intrigue the audience by making them laugh, while an introverted, individual, no matter how linguistically competent they may be, will not perform well enough in improvising the assigned role.

Carefully selected, authentic photographs are an excellent stimulus for expressing thoughts, whether it is a short commentary, a long discussion, or a critical review (Tettamanti, Talini, 2003). Students can thus express pro and con arguments in relation with photograph-inspired claims (e.g., animal photograph; *Pets pollute the environment; Pets make people altruistic; Pets are great company for lonely people, etc.*) or proverbs (e.g., photograph of two lovers; *Love is blind, Love conquers all, etc.*). All these exercises, whether conducted orally or in writing, have a clearly defined goal: to accelerate the lexical progression of students and to contribute to the systematic expansion of vocabulary.

2.2.4. Work on cultural elements of language

In addition to linguistic knowledge, a linguistically competent foreign language speaker must master the paralinguistic, extralinguistic and sociolinguistic knowledge, which implies changes in behaviour depending on the context in which the speech act takes place in such a way that it is fully acceptable to native speakers. Human communication consists of verbal and nonverbal communication signs. Verbal communication is achieved by an individual through speech, while non-verbal communication is one that comprises non-verbal signs. These are all those signs that participate in the speech act and are not speech themselves (Navarro, 2010). Knowledge of the nonverbal component of language is extremely important for the acquisition of general language competence; accounting for 93% of communication determinants (Navarro, 2010).

The most studied part of nonverbal communication is certainly gestures. They are used as a supplement to a spoken message or as a complete or partial replacement for a verbal statement. In Italy, they represent an especially important means of

communication and are considered an integral part of its linguistic and cultural heritage. By resorting to gestures, Italians express various communication functions: feelings and emotional states, descriptions, actions, opinions. Our attention should be focused on those gestural forms that are culturally strongly coloured and as such insufficiently understood or completely unknown to foreigners (expression of disinterest or indifference by repeatedly rubbing the fingers of the palm on the neck; *I do not care at all*, expressing your own cunning by lowering your lower eyelid with your index finger; *I don't believe you, I'm cunning, you can't outwit me...*). The observed gesture can be presented to students with a short definition, drawing, keyword, expressive register or accompanying verbal expression. Students can thus be invited to recognize the perceived gesture and define it in one of the above ways. This type of exercise encourages students to be independent in presenting their own assumptions, which creates the conditions for the development of particularly important creative thinking. Furthermore, the teacher can be the author of short, well-designed dialogues whose text can be replaced by an appropriate gesture. It is important that the vocabulary is adapted to the general and linguistic knowledge of students and that the presented gestures are conventional, explicit, and currently relevant across Italy. Equally, it is necessary to consider the polysemy of certain gestures. Ignorance of the meaning of a gesture in relation to the communication context in which it is used can result in misunderstanding of the message (Diadori, 2003). Equally, indiscriminate recourse to elements of one's own language often results in sending an inappropriate or incomprehensible message. The Italian using the gesture "*mano a borsa*" becomes unusual for the Anglo-Saxon culture, which is not familiar with the gesture. It is a specific movement of the hand placed in a bang with joined fingertips. This gesture increases the intensity of the uttered questioning statement and introduces elements of astonishment, indifference and or irony, and it is possible to paraphrase it with the words (*But what do you want/do/say?*)

Non-verbal communication elements are a welcome stimulus to discuss the existence or non-existence of the same or similar elements in one's own culture. However, it is necessary, from the very beginning of language learning, to anticipate the possibility of interference of one's own culture to understand and master the culture of the target language.

A direct call to compare individual elements with the same or similar elements in your own country has an ambitious goal: to become aware of the features of your own cultural and linguistic reality and accept the diversity of the other side (e.g., *Does this photographic motif seem typical Italian? Is it possible to create the same or similar photo in your country? How would they differ?*). Working with photograph results in the development of students' sense of tolerance, respect, and openness to the culture of our neighbouring people. This is an assumption that results in the strengthening of cultural awareness.

3. TV film

A TV film is referred to as an exceedingly complex art, an effective medium in evoking emotions and a commercial venture to have been quickly recognized as the first truly mass form entertainment. Encompassing all its complexity there are two distinctive areas of film-related studies – (1) film studies researching films as an art form and (2) media education focusing on proper interpretation of films as powerful media. Hence,

film-related studies examine films from different perspectives for a variety of purposes: as an art form, as a type of mass medium or popular culture, as an instructional and an educational technology.

As an educational technology comprising authentic language input, film displays plentiful advantages that are intuitively obvious to anyone (authenticity in terms of linguistic and cultural information, multisensory information, appeal, etc.). Due to these, benefits of using films in FLT seem to have become a truth universally acknowledged. Films are also increasingly adding a new dimension to formal and academic language learning making it an extension of entertainment and leisure normally pertaining to incidental language learning.

Both theoretical and empirical research and studies within the fields of educational technology and psycholinguistics lend an insight into legitimacy and advantages of film- assisted language acquisition. Studies conducted by researchers (Webb, 2011, Etemadi, 2012) confirm that watching films and incorporating them in a language curriculum targets all the major language skills- reading, listening, speaking, and writing as a whole without artificially isolating each skill resulting in increased effectiveness of language instruction. Nath, Mohamad and Yamat (2017) refer to films as being facilitators in foreign language acquisition by lowering language learning - related anxiety and enhancing students' motivation and self-confidence.

3.1. Selection Criteria

However, for all the benefits of film-assisted learning, there are also concerns and challenges to be addressed whilst selecting proper films most suitable for language learning purposes. Being a form of popular culture, films are associated with a wide array of concerns ranging from harmful (violence, substance abuse) to problematic content (students' self-definition and identity negotiation, stereotyping). This has called for a detailed and systematic approach to appropriate movie selection based on the characteristics of foreign language study. According to Kwon (2014), this approach should involve adhering to the following set of selection criteria. Basic criteria refer to the suitability of a film for a level of students' proficiency, its appropriateness for certain age and cultural/ethnic background of language students, to its being of high artistic and technical quality, to its clear and sequential plot presentation, to its favourable reviews and rankings.

Linguistic criteria cover language-specific characteristics of an effective film for FTL: realistic styles of speech (colloquial, semi-formal, formal), pronunciation clarity, vocabulary complexity (acceptable amount of slang, jargon), relatively clean language (infrequent profanity), and a well-written script.

Social-psychological criteria focus on the educational value of films coming from their motivational value and cultural importance and unique challenges of language students identifying themselves in a target language. In an attempt to completely minimize the negative impact resulting from problematic content, teachers tend opt for a film that represents a generally positive message and value, displays relatable (universal themes, ordinary people) and representative (reflection of social attitudes) content, a minimal extent of bias, discrimination, and stereotyping. However, representation of these could effectively turn into a specific objective of the film as a social message encouraging students' critical thinking, prompting self-expression.

These criteria addressing general content-related concerns make for a common threshold within the process of film selection best fitted for language teaching purposes. However, ultimate decision on addressing specific concerns in a specific case requires a set of specific-instructional criteria. Seeking to increase students' motivational levels, the specific criteria emphasize the suitability of a film for achieving a specific teaching objective and its responsiveness to students' psychological needs and interests. Considering a variety of teaching objectives, several factors could be considered determinative based on the maturity level and characteristics of a particular group of students, which could result in turning some content-related issues into unnecessary concerns.

3.2. Objectives

It is worth noting that designing a program of study using films requires deciding on the objectives overlapping with the specific-instructional selection criteria on a case-by-case basis and completely drawing upon the benefits displayed by films. The four main types of objectives are distinguished: linguistic, cultural, psychological, or motivational and other pedagogical aims.

In terms of linguistic objectives, development, and improvement of listening, speaking, reading, writing and vocabulary skills are usually the initial targets educators set their sights on. A significant boost in listening and speaking skills is proven to be provided by movie-assisted learning, whereas enhancement of writing, reading, and vocabulary skills may be generated through a proper blend of film features and accompanying materials.

In addition, cultural or content-related and motivational objectives (e.g., cultivating students' interests in study and higher literacy) may be seen as benefits that are naturally displayed and may be viewed as an add-on value or secondary objectives. These can be selected as primary objectives and additionally supported by adequate teaching activities.

The process of implementation of films in the language program may be conducted on the levels of an isolated lesson plan, permanent part of course, separate course or the entire program with its own courses. We have opted for designing drafts of an isolated lesson plan of an intermediate to upper-intermediate general English language course delivered at the tertiary level of ELT. This lesson structure primarily aims at enhancing students' listening, speaking, comprehensive skills, cultural competence, generating their greater attention and fostering development of their critical thinking skills. Given the time constraints pertaining to a language class, a constant need for to the justification of time and optimization of effort put into movie-assisted language instruction has prompted us to consider utilization of a TV show instead of a film. A brief analysis of their limitations and affordances has resulted in a slightly advantageous position being assigned to a selective episode of a TV show due to its duration of up to 45 minutes, which could effortlessly fit into a single class.

3.3. TV show - *Orange is the New Black*

The selection of *Orange is the New Black* has been conducted in accordance with all the selection criteria delineated by Kwon (2004). However, in compliance with the specific-instructional criteria (particularly a higher maturity level of students), some

balancing between some linguistic and socio-psychological criteria has been required. Placing special emphasis on representation of bias, discrimination and stereotyping and conveying it as a social message of the show implicated the use of a fair amount of profane language, predominance of slang, jargon, and colloquial and blunt speech styles. It seeks to achieve a set of objectives through accompanying activities that are to be laid out in the following chapters on principles of developing a lesson plan. Partially based on a novel, the show is a critically acclaimed comedy-drama streaming show that has also been perceived as ground-breaking from a few content-related aspects. By focusing on society's most marginalized voices – Black and Latino women, queer women, drug addicts placed within an American prison and as seen through the eyes of a white, middle-ground, status quo woman convicted to a fifteen-month prison sentence, this dramedy brings up a lot of relevant issues such as women's, transgender rights, prison reform and immigration. Taking on all the story lines that are marvellously laid out has resulted in raising awareness for all of them respectively, prompted a sweeping narrative and perception shift and generated a significant impact on a society as a whole.

3.4. Principles of developing a lesson plan

Kucher (2019) lists three types of activities as necessary requirements for an effective organization of a lesson using TV shows: pre-watching, while watching, and post-watching. A selective, thirteenth episode within the fourth season has been chosen due to its social message reflected through the most vivid anticipation and portrayal of pressing American social and discrimination issues and its infrequent linguistic profanity.

3.4.1. Pre-Watching

The introductory part of a TV-show based English lesson should comprise an outline of any content-related, cultural and vocabulary elements that may be difficult for students to understand. Understanding the general idea of the show and making the theme relatable and relevant for students can prompt their engagement and willingness to watch the show, activate their linguistic knowledge and speaking and reading skills. This could be achieved through a warm-up discussion starting with a few broad questions referring to students' affinity for watching TV shows: *Do you prefer to watch films or TV shows? Why? What is the last TV show or film that you saw? What is your favourite TV show or film? What makes it special and memorable?*

This could serve as lead-in into a reading comprehension activity requiring students to answer a list of comprehension questions upon reading a text containing general information on the show. The comprehension sheet introduces the show's main characters, gives the reasons for its success, lists a set of social issues the show tackles, outlines its purpose and legacy – *Is Orange is the New Black a success (give two reasons), What social issues has it dealt with? How has it impacted on its viewers? Are women portrayed in diverse types of roles? If so, why is that important? What is the legacy and purpose of the show?* Further discussion is to be prompted by a set of guiding questions on the episode's themes that I have recognized – racial discrimination, mistreatment of prison inmates, lack of legally enforceable imprisonment and safety laws, corporate bureaucracy, mismanagement of correction facilities. At this point students are told some basic information on the episode's main

character (*Poussey is a Black non-violent offender serving a four-year prison sentence for trespassing and possession of half an ounce of cannabis*). Afterwards they are given the title of the episode *Toast can never be bread again* and asked to make one or two predictions to share with a partner – *Based on the title, what do you predict it might be about? Write three words that you may hear in a show.* (Ferlazzo & Sypnieski 2018). Finally, introduction of students to the main vocabulary in the episode should focus on a brief explanation of words and idioms that are most important to understand the plot.

3.4.2. While – watching

While-watching activities are aimed at activating students' attention and interest to facilitate their retention of some basic information on the episode – information on the episode's main characters, major plot events and at encouraging students' speaking and listening practice. They should not be adding up to the overall overload of comprehending the storyline and possibly causing students' underperformance through their overwhelming complexity and multitude. Instead, they should comprise identifying true or false statements, matching exercises, multiple-choice questions, short answers, pause and predict activity. There is a range in variations as to how they could be used; with and without making pauses after playing certain scenes. Our "true and false" activity involving making pauses requires students to answer a true and false question and write a reason they think it is false. They can share it with a partner and then present it orally in the classroom.

The pause and predict activity also include pauses after which students make predictions on what is coming next by sharing them aloud with their partner or writing them down. Ferlazzo & Sypnieski (2018) suggest encouraging intermediate students to share their thoughts behind the predictions with the simple sentence frame, "I predict... because..." They can be asked to share them on a section-by-section basis or at the end.

In regard with the episode's stirring narrative and depending on the students' English-proficiency and motivational levels, students may be even asked to engage in a few more demanding production activities. These are made up of reproducing what is being said, describing what is happening and summarizing events. Given the challenge these activities pose, students will need guidance, help and reassurance in their efforts to benefit from them.

3.4.3. Post-Watching

A variety of post-watching activities account for the final and most comprehensive phase of the show-based learning and teaching scaffolding. They aim to consolidate their comprehension of the plot, reinforce students' lexical, syntactical knowledge, and enhance their cultural competence and critical and analytical thinking. Storyline comprehension and vocabulary consolidation can be easily achieved through some exercises that are similar to the ones used in the while-watching phase such as predict and pause, reproduction and summarizing activities and that have been adjusted accordingly. As for a predict and pause activity, students are asked to revisit their initial predictions and revise them through the following sentence frame: "My first/second/third prediction was... right/wrong because..." (Ferlazzo & Sypnieski 2018).

Their understanding can be further checked through the questions: *Were your predictions correct? Did you hear any of the words? Write two prominent issues the show is concerned with? Write the part of the show you liked most? Write how this show made you feel? If you had to use only five words to describe this show, what would they be? If you could give this show a new title, what would it be and why?* Sharing these provides them with additional speaking and listening practice. The reproduction activity aided by replaying a certain scene for repetition may be expanded to a role-play activity. This involves encouraging students to act out a scene using as much of the original version as possible thus providing them with an opportunity to apply what they have been learning and preparing them for real-life situations. With confident and language proficient students it can evolve into a more creative activity in which they are stimulated to improvise the scene to fit their views of the situation and the characters they are playing. Dialogues between Mr. Caputo, Director of Human Activities and MCC's Public Relations representative and Mr. Caputo and Taystee Jefferson, an inmate could be easily used to this end. The former manifests a formal manipulative rhetoric used by a corporate employee, whereas the latter reflects a semi-formal and even informal speech style bursting with the inmate's anger and powerlessness. The optional summarizing activity could revolve around students' writing a summary of the episode's key idea.

Special emphasis should be placed on the lexis, syntax and discourse used in the show. A set of vocabulary exercises primarily targets plentiful lexical and syntactic structures such as phrasal verbs, collocations, and idiomatic expressions. The conversations between the two inmates, the show's two main characters, Piper Chapman and Alex Vause and Alex Vause and a counsellor Berdie Rogers display abundance of a variety of all the structures, respectively. The former exemplifies a list of nouns denoting several types of fruits (*cantaloupe, pear, pomegranate, persimmon*) and idioms (*you get what you pay for, to cross the line, take one's business elsewhere*), and the latter manifests an array of jargon and slang terms (*shill*) and idiomatic expressions (*a quilt of lies to sew*). Both dialogues could be utilized for reinforcing new lexis through requiring students to produce the corresponding translation equivalents, detect other idiomatic expressions containing the same constituent (a noun or a verb) or practice word association by similarity.

Students' critical and analytical thinking could be prompted through providing them with an opportunity to analyse the episode's storyline, critically evaluate the shown situations, make inferences and predictions about the future of the characters through pair and group discussions and interactions. Students' cultural competence could be aptly boosted through placing special emphasis on the discourse used in the scenes showing the organized wake upon Poussey's death. Through cultural and references and cultural appropriacies of verbal and non-verbal communication displayed within groups of Black, Latino, and white women, students are provided with a glimpse into the three subcultures' customs and beliefs as reflected through accompanying discourses. The discourse revolving around the syntagm "Black lives matter" used by Black women highlights the racial dimension as a part of their constant struggle. Furthermore, cross-cultural comparisons could be carried out resulting in raising students' cultural awareness. Students may also be encouraged to relate to some culture-related issues and situations. Finally, a debate may be organized where students would pick a side in an argument, use as many details as possible from the

episode to support their points, and convince other students. Given the show's social engagement and topicality, the debate's theses may be: *Poussey's death and its aftermath are part of a failure of the prison's privatization. Poussey's death and its aftermath speak to racial discrimination and law enforcement brutality.* If there is enough time and interest, the theses could also be challenged by con claims. On balance, post-watching activities provide a powerful space to reflect on the situations, relationships, opinions, and values, as they are perceived by different people and synthesize the complex whole of numerous benefits of TV-show-assisted English language learning.

4. Conclusion

Authentic teaching materials, selected according to the above criteria, are serious teaching content. The authors themselves are also happy to apply them, and the reasons that make them didactically justified and desirable are indeed many:

- authentic materials that bring freshness and dynamism to an artificial classroom atmosphere
- easy-to-understand scenarios make them usable at all levels of language proficiency
- are extremely practical motivational tools because the corresponding exercises can be prepared in advance and saved for multiple use
- depending on the needs of the teaching moment, they can be used several times and in different ways (completely, partially, with and without sound or image)
- as means of communication, they indirectly transmit information from various fields of human activities: culture, history, politics, and sports
- with their bright colours and distinct suggestiveness, they attract attention and arouse curiosity. Curiosity is an important prerequisite for the adoption of new content
- the vagueness of the stopped moment of reality in a unique way stimulates the thinking and fantasy world of students
- visual and auditory elements complement verbal expression and in combination with linguistic signs improve data memory
- expose students to different language registers, languages by regions and certain areas of interest. Exposure to only one variant of a foreign language, only one idiolect, cannot enable the student to understand the spoken language in all its variants at the phonological level.
- are suitable for practicing and working on all four language skills
- are unique means of integrating cultural data among students (family structure, the role of women in society, moral values...)
- enter the necessary interaction between teachers and students; it is about the ever-present interaction necessary for successful foreign language teaching
- encourage critical thinking and taking a stand on the message they convey
- sensitize with the intercultural dimension of linguistic teaching

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COOPDEV PROJECT: LEARNING DEVELOPMENTS THROUGH DIFFERENT METHODOLOGIES AND STRATEGIES

Vicente Monfort

Florida Universitària, Catarroja (Valencia), Spain
vmonfort@florida-uni.es

Yolanda E-Martín

Florida Universitària, Catarroja (Valencia), Spain
yescudero@florida-uni.es

Abstract. The educative experience aims to join and find common ideas between project-based learning and service-learning. Project-based learning aims to achieve knowledges and skills by working on an authentic and complex challenge, while service-learning is an educational approach, which combines in one project a process of formal education and a service to the community. In this work, we try to join the best practice of each learning methodology and apply it to students in the second year of a vocational training, working with low-income non-profit organization. To do that, students are organized in groups and apply the scrum methodology to manage the project and the team, where the role of the product owner is run by a non-profit organization member integrated into the student's team. Since the beginning of the second year, students work on the management and preparation of the project, but it is just during the last two weeks of the course when they develop the product in an integral and intensive way through a project-based learning methodology. Evaluation will show that both parts gain benefits: students get to work on a real project and non-profit organizations get an initial prototype, which might daily.

Key words: *project-based learning, service-learning, scrum*

1. Introduction

This paper aims to analyse an educative experience that joins and finds common ideas between project-based learning and service-learning (Dewey, 1986). Project-based learning aims to achieve knowledges and skills by working on a real and complex challenge, while service-learning is an educational approach, which combines in one project a process of formal education and a service to the community. In this work, we present an educational experience where we try to join the best practices of each learning methodology and apply it to students in the second year of a vocational training, working with a low-income non-profit organization. To do that, students are organized in groups and apply scrum (Takeuchi & Nonaka, 1986), a well-known agile project management, to manage the project and the team.

This section continues with a review of literature about project-based learning and service-learning methodologies, and scrum methodology and its use in the educational context.

1.1. Project-based learning

In recent years, project-based learning (PBL) methodology is gaining more popularity among teachers and education centres. PBL is a very participatory educational method that aims to work on a specific topic in a transversal way. It involves several activities, subjects, and content. The most characteristic and differential element of a PBL is that all the actions of the students are focused on the same direction and have a common objective: to develop a final product. This can be a research paper, a model, a computer application, etc.

PBL consists of designing, programming, and implementing a set of tasks associated with the same theme that end up in a final product, which reflects what the students can do with the learning they have been getting.

The development of a PBL is complex and transversal. It usually has the following characteristics:

- Usually, PBL works cooperatively, although it can also be combined with individual research or developing tasks.
- In this type of educational projects, the learning is intended to relate to the students themselves in three ways:
 - Contextual: For instance, a final product made for the neighbourhood where they live.
 - Motivational: Professors will try to work with current and interesting topics for the class group.
 - Productive: Learning must have a practical and immediate use for students, so that it serves them to develop other actions.
- The aimed final product should be created, executed, and presented as a group.
- The students become the protagonists of their own learning, promoting teamwork, critical thinking, and research, as well as autonomy and individual responsibility.

1.2. Service-learning

The service-learning is defined as a solidarity service aimed at meeting the real needs of a community, actively accomplished by students from planning to evaluation, and intentionally articulated with the learning content (curricular or training content), reflection, development of skills for citizenship, work, and research.

Service-learning is an innovative methodology in which, through the modification of reality, an attempt is made to improve student learning. It takes as its basis competency-based education, learning by projects or problems, cooperative and collaborative learning, the promotion of entrepreneurship, multiple intelligences, positive coexistence, gamification, etc. In addition, the promotion of student autonomy prevails. Service-learning has become an innovative tool among those who seek a renewal and a new approach to the current educational system.

Education experts define three essential features of service-learning:

- Active role: the activity is actively led by students, supervised by formal or non-formal educational teams.
- Solidarity service: aimed at meeting real needs of a community. Specific activities are planned, appropriate and limited to the age and abilities of the students and aimed at collaborating in the solution of specific community problems.

- Intentionally planned learning in relation to solidarity activity: the project articulates the learning of curricular content, in the case of educational institutions, or training, in the case of social organizations.

The benefits of the service-learning are summarized as follows:

Develop critical thinking, problem solving, leadership, decision making, collaboration and communication skills.

- Build positive relationships with community members.
- Connect your experiences with academic subjects.
- Develop a deeper understanding of oneself and greater empathy and respect for others.
- Apply your energy and creativity to the needs of the community.
- Raise public awareness of major social issues.
- Teamwork and collaborative.

1.3. The Scrum methodology

Scrum is an agile manifesto methodology (Beck, et al., 2001) used in software development based on an iterative and incremental process. Scrum is an agile development methodology used in software development based on an iterative and incremental process. Scrum is an adaptable, fast, flexible, and efficient agile framework that is designed to deliver value to the customer throughout the development of the project. The main objective of Scrum is to satisfy the need of the client through an environment of transparency in communication, collective responsibility, and continuous progress. The development starts from a general idea of what needs to be built, drawing up a list of features ordered by priority (product backlog) that the product owner wants to obtain.

In scrum, there is a team, which is focused on building quality software. The owner of a scrum project focuses on defining the features that the product to be built must have and overcoming any obstacles that might hinder the development team's task. A scrum team consists of the following roles:

- **Scrum master:** It is the person who manages the team guiding it to comply with the rules and processes of the methodology. The scrum master keeps scrum up to date, providing coaching, mentoring, and training to the teams in case they need it. He or she also works on the decrement of project's impediments and works with the Product Owner to maximize the Returns of Investment (ROI) (Sutherland & Schwaber, 2020).
- **Product owner (PO):** It is the representative of the external stakeholder interests and is responsible for the ROI of the project (Sutherland, Scrum: The Art of Doing Twice the Work in Half the Time, 2014). He or she defines the requirements and documents them as user stories in the Product Backlog and prioritizes them on a regular basis.
- **Team:** Group of professionals with the necessary technical knowledge who develop the project together, accomplishing the stories they commit to at the beginning of each sprint (Rising, L.; Janoff, N.S., 2000).

In scrum, there is a list of events (Sutherland & Schwaber, 2020), which facilitates the adaptation of some aspect of the process, the product, the progress, or the relationships. They are defined as follows:

- **Sprint:** It is the development of the set of tasks planned in the Sprint Planning. A Sprint can range from 1 to 4 weeks.
- **Sprint Planning:** It is a meeting at the beginning of a Sprint where team members define the set of tasks to be done in the Sprint.
- **Daily Scrum:** It is a daily meeting where the team members update each other on their progress, difficulties they have experienced, and their future goals.
- **Sprint Review:** It is a meeting where the team reviews what happened in the Sprint and if the tasks were accomplished according to the plan. In this meeting the Product Backlog is updated.
- **Sprint Retrospective:** It is a meeting where the team thinks about what went wrong (if something happened) and plans improvements to the next sprint.

In scrum, there is a list of artefacts, which are designed to ensure transparency of key information in decision making. They are defined as follows:

- **Product Backlog:** It is managed by the PO and is an sorted list of everything that is known to be needed in the product.
- **Sprint Backlog:** It is the set of Product Backlog items selected by the scrum Team for one Sprint.
- **Burndown Chart:** It is a way of representing the speed of the team, showing in a graphic how the team is performing according to what was planned for the Sprint.

1.3.1. Scrum in an educational context

Delhij, van Solingen, & Wijnands (2015) developed eduScrum, a variant of the scrum methodology for educational purposes, which intendeds to cover the specific needs of developing projects within the classroom, limited by fixed schedules and number of sessions. It is a framework for preparing students where responsibility for the learning process is delegated from teachers to students

The projects developed within the classrooms of an educational center are far from the ones developed in a business environment. For this reason, eduScrum proposes a series of variants in the roles of scrum, to adapt them to the classroom and its characteristics:

- **Product owner:** this role is developed by the teacher who will be responsible for the supervision and evaluation of results. The teacher (Delhij, van Solingen, & Wijnands, 2015):
 - Determines what and why to learn
 - Monitors and improves the quality of the acadèmic learning outcomes
 - Tests and assesses the acadèmic learning outcomes and monitors personal development
- **eduScrum master:** this role is developed by a membre of the team that will play a dual role of eduScrum master and membre of the team.
- **Team:** it consists of the group of students including the eduScrum master.

The main difference between eduScrum and scrum is that the teacher must influence the pace of the students. In addition to that, there is less uncertainty because of the course syllabus, which is well-defined in educational centers. On the other hand, Sprint

Reviews and Sprint Retrospective are perfect platforms for continuous improvement in student teams.

The eduScrum methodology has been used widely combined with PBL (Dinis-Carvalho, et al., 2011), (Krehbiel, et al., 2017), (Fernandes, Dinis-Carvalho, & Ferreira-Oliveira, 2021), (Xiang & Han, 2021), and service-learning (Nejmeh & Weaver, 2014), (Bloomfield, Sherriff, & Williams, 2014), (Robinson & Hall, 2018).

In this work, we try to join the best practice of PBL and service-learning methodologies and apply it to students in the second year of a vocational training, working with low-income non-profit organization. To do that, students were organized in groups and applied a slightly different version of eduScrum to manage the project and the team; in our work, the role of the product owner is run by a non-profit organization member integrated into the student's team.

The rest of the paper is organized as follows. First, we introduce a formal description of our educational experience, namely CoopDev Project. Then, we define the implementation of our experience. Finally, we present results according to findings from students and non-profit organizations.

2. CoopDev Project

Starting from the basis of the institutional educational model CoopLearning taught at Florida Universitària (2020), we apply it within our project developed in the second year of Vocational Education of Web Application Development. Based on this methodology, we adapt it according to the needs required by the nature of technological development studies.

Contextualizing the project developed, it should be noted that it is a project accomplished during the second and last year of the Training Cycle. The target of the project is to achieve a minimally viable product by combining the skills and competences acquired during the two courses and taught through all the modules.

The project starts at the beginning of the academic year. At this moment, we make the teams, look for entities to work with (later this aspect is developed), and prepare all the artifacts to be able to start with the development. Throughout the course, different stages are developed, and it is during the last two weeks of the course where the teams work intensively in the development of the project, paralyzing the classes and attending only and exclusively to the project. The initial objective of the Integrated Project, which is what this practice is called in our educational community and is extended to all degrees, is to try to combine all the skills acquired in all the modules and focus them on the preparation of an artifact. In addition, this Integrated Project is accomplished as a team, with which transversal skills required for their training as a professional, are put into practice during its realization.

From the degree of Web Application Development, the teaching team considers the realization of this practice, fundamental for the training of the student. The Integrated Project offers so many benefits that we give it the importance it deserves, in addition to trying to associate certain extra practices that give it even more benefits.

During this academic year 2021-2022, we have introduced a series of changes, which we can mention below:

1. Project-based learning: We start the integrated project at the beginning of the course and drag it to the end of the course. We treat it as a project, with a gradual achievement of goals. This gradual achievement of milestones can be summarized as follows:

- Creation of the teams and organization.
- Contact with the entity.
- Project agreement with the entity
- Mockup proposal
- Successive meetings with the entity/client
- Intensive development during the last two weeks

2. Service-learning: We put knowledge at the service of the community, developing real projects accomplished to nonprofit associations with specific needs that are difficult to afford.

We established four teams, each of which developed a project by and for a partnership. The objectives can be seen from three different points of view:

- Partnerships: obtain a professional and functional web application, difficult to assume from the economic point of view. These associations function as customers, integrating a person within the scrum team under the figure of Product Owner.
- Students: Develop a real project with a real client, as a team with colleagues and applying the knowledge of all modules.
- Teachers: Try to obtain a real environment of development and work, which will be found a few days after the end of the project.

3. Scrum: The team is established as a self-managed scrum team. The teaching staff offer technical assistance to the problems that may arise during the development of the project, but we are not integrated into the scrum structure.

This structure is made up of members/students of the team and the person of the association that will act as Product Owner.

The scrum framework provides us an optimal environment for team management and good development planning. Although, we introduce some modifications on the scrum since the project is not accomplished during all calendar days and this alters its nature a little:

- Daily meetings: Daily meetings are only held when it is a day of work on the project. Its importance is vital. In our case it will have been a few days since the last day of work on the project.
- Product backlog: A good management of the tasks to be performed, dissected, and prioritized is basic for the success of the project. To make it, the opinion of the Product Owner (member of the association) is vital.
- Sprints: This artifact may be the one that most differs from the scrum. Our sprints during the course are very marked and with a slightly longer duration in time. It is in the last two weeks of intense technical development that the sprints differ. It is now when they are much shorter than in a model development because we only have two weeks.
- Scrum Master: It is a member/student of the team who exercises this role. Although the figure of the Scrum Master should be a member with experience and skill in scrum, it offers a rich learning opportunity. Teachers support students with that role.

3. Implementation

We start the project during September and October. During this first phase:

1. We make the teams according to technical and human criteria trying to balance all the teams in all aspects to achieve a good preparation of the project.

During this course, 4 teams have been made, which have been tutored by a teacher. Nowadays, in the degree which it is developed there are 4 technical modules and the teachers from these modules are the tutors of the teams.

2. In parallel to the previous phase, we proceed to the search for associations or NGOs that are interested in collaborating and participating in the project.
3. With the teams and the associations chosen, the team-association relationship is established.

After this initial phase, the teams contact the associations and set up some meetings. Until the Christmas holiday period, the teams hold an average of 2 meetings to elucidate and clarify all aspects related to the project and its work plan. It is during this phase that the teams focus on the development of the mockup.

The mockup must be validated by the collaborating entity, always under the supervision of the project tutor.

The tutor of the project can attend the meetings with the associations, but always exercising a passive role, noting any aspect that he considers important to be able to transmit to the students later and in private.

From the beginning of the project and when the students get to work on it, they use two basic tools for management:

1. GitHub: They use this repository and version control tool where they will deposit any element related to the project. In addition, they are forced to use a specific workflow, which is shown in Figure 1. As can see, a series of branches are established:

- master: is the principal branch. In it you never work directly, and the changes are synchronized with the rest of the branches.

A series of rules are also established to increase safety. Among which we can highlight the creation of pull request with a certain number of positive revisions to be able to accept the changes in the repository.

- the rest of the branches have a similar operation, where they work directly on the corresponding aspects.

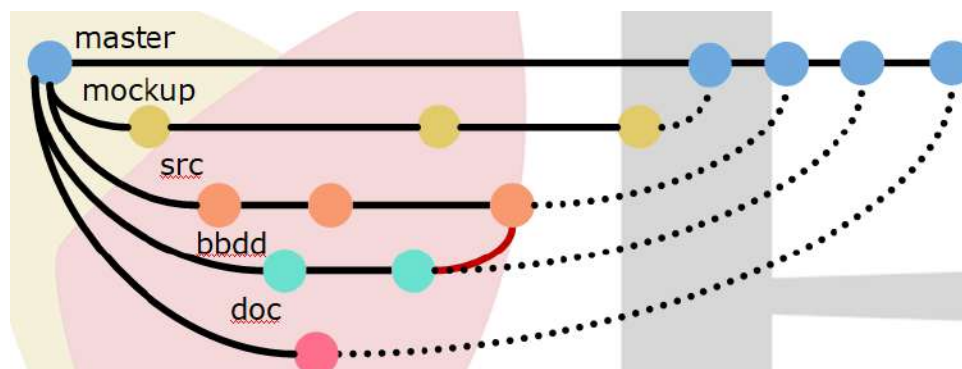


Figure1: GitHub workflow followed during the project.

2. Trello: This tool is used for project management. The obligations with the tool are:
- At least 3 lists: TO DO, DOING, DONE.
 - Activating the GitHub Power-up to be able to access the repository from Trello. With this addition, we can reference directly from Trello tasks to commits or GitHub branches.

Apart from these two needs, we give freedom to the teams to be able to parameterize the tool to their liking: they can have more than one list, they can manage the WIP (Work in Progress) as they deem, etc.

During the following weeks and until the last two weeks of the course, the groups have two tasks to perform:

1. Moving forward in the realization of the report, which they will have to present at the end of the project.
2. Making the product backlog, prioritizing, and estimating the effort. This element is basic for the success in the realization of the project. It must be done together with the Product Owner.

The last and most intense phase of the project is the technical development of the project. This is done during the last two weeks of the second evaluation. During the 2021-2022 academic year, it took place from 7th to 20th February 2022.

In these weeks, students and teachers come to the educational center at their usual schedule. The only difference from the rest of the course is that only during these two weeks they focus on developing the project; they have the support of the teacher who is currently in the classroom.

During this intensive technical development phase of the project, teams must obey the previously developed product backlog.

Teams will have to follow a scrum development with a temporary modification. The sprints in our project are much shorter in duration, due to the time we have. The sprints performed by the students are 2-3 days long.

Because they are in an agile scrum development, they must hold a daily meeting, prepare a sprint review at the end of it and of course have the product backlog updated and duly prioritized.

When all the work is done, it is time to do the presentation of the project. This year it was done on 23rd February. During all the morning, the 4 teams present the project trying to show:

- The result of the product. They must do a demo, showing all the features they have developed.
- Technologies used.
- Team management.
- Association relation.

At the same time students are doing their presentation, teacher is evaluating. At this moment, teachers are only evaluating presentation aspects following a form. The aspects we are evaluating are:

- Organization
- Visual elements
- From each student:

- Speaking
- Posture and gesture
- Answer to questions

We obtain a mark from 0 to 10. For this paper this mark will be labeled as PM (Presentation Mark).

It is a challenge to evaluate and qualify the project. Due the project is not an official module; this doesn't appear in the official report grades. We integrate into the different modules which are participating in the project.

All the modules that are participating in the project must evaluate each team. Each module makes a rubric and evaluate the project with the required requirement. Nowadays 5 modules are participating on the project, 4 technical modules and English module. This mark is calculated as shown:

Module 1 (Interface design)	20%
Module 2 (Server development)	30%
Module 3 (Client development)	25%
Module 4 (Web deployment)	15%
Module 5 (English)	10%

We obtain a mark from 0 to 10. For this paper this mark will be labeled as MM (Modules Mark).

We introduce a new mark, which is the one offered by the peer review (PR). Each student must evaluate the other teammates. We prepare a form, which is answered after they finish the project. The questions are:

1. Questions that are graded from 1 to 5:
 - Performs the tasks assigned by the group within the required deadlines
 - Actively participates in the team's meeting spaces, sharing information, knowledge, and experiences.
 - Collaborates in the definition, organization and distribution of group tasks.
 - Considers the points of view of others and gives constructive feedback
2. In the next question, the student has to distribute 100 points among all team members
 - How would you distribute 100 points among your teammates? The idea is that you should distribute 100 points among the team members. So that the total of the points distributed is 100 and no more.

For that, you must prioritize some colleagues for their effort, dedication, camaraderie, respect... all the criteria you consider.

With all these criteria, we obtain a corrective factor, which is a number between 0 and 1,5. This is the peer review mark (PR). This factor is obtained from a complex calculation.

The final mark (FM) from the project for each student is the result of:

$$FM = (0,5*PM + 0,5*MM)*PR$$

As mentioned above, there is no official module for the project, thus the mark must be included in the participating modules of the project.

According to that, the mark affects the 2nd evaluation of the 5 modules. In each module, the percentage of hours done in the project in the second evaluation is the percentage that the mark of the project affects the final mark of the module.

In order to illustrate it, a module has in the 2nd evaluation 50 hours, and it has used 10 hours (20%) for the project; so the final mark is:

Module Final Mark = $0,8 * \text{Module Mark} + 0,2 * \text{FM}$ (Final Mark of the project).

When the project is done, finished and evaluated, we invite the teams to exhibit their project in a conference organized at Florida Universitària, called Florida Expo. It is a meeting between old and new students, companies and of course the collaborating associations during the project. all the students of our educational center have the opportunity to show their integrated project.

Although it is a voluntary act, this course was attended by all the project participants, both students and associations.

4. Discussion and future work

1 month after the end of the project and with the students doing internships in a company, we sent them a satisfaction questionnaire that addresses several issues.

We let so much time pass, so that they can answer with perspective of what has been done and already being in a work environment, so that they can assess what the project has given them.

The form is based on 15 questions:

Questions 1 to 7 are graded from 1 to 4 as shown in the Figure 2.

1. values the satisfaction of teamwork

- Very satisfactory 53%
- Satisfactory 41%
- Not very satisfactory 6%
- Unsatisfactory 0%

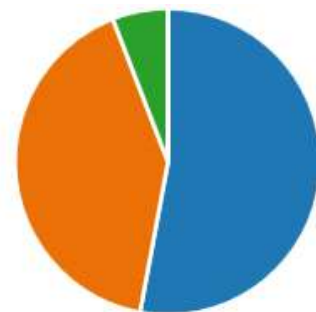


Figure 2: Illustrative graphic

It is remarkable the answers in question number 2 “Assesses the satisfaction of carrying out a real project for a client”. There is only a 6% of difference between Very satisfactory and Satisfactory (44% and 38%).

In question number 4 “Values learning throughout the project process”, there is no answers for the last 2 options:

- little significant learning
- insignificant learning

In this question high significant learning is the most answered with 65%.

More than 75% of the students reckon that the management by the teaching staff is good or very good.

94% of the students reckon that the evaluation and rating mechanism is good or very good.

For questions 8 to 10, the answers are Yes or No.

For each one more than 80% of the students answered positively.

To illustrate this 88% of the students answered Yes the question “Do you think that the project has had a positive impact on your training?”.

Questions 11 to 15 are open questions; students can write their own answer. A sample of answers are:

- 2 weeks there is not enough time.
- I think you learn more by doing something for a real client than for yourself.
- Linking it to associations is fine, but I think some of the creativity is lost
- You learn to work as a team, at first, I think that it was necessary to define the individual roles beforehand with the help of the teaching staff, it is something difficult to define once the project has begun.
- Offer the possibility and let the students themselves decide to collaborate with the associations, in some cases I think there has been a lack of more direct contact with the association by the students
- I felt satisfied. Communication with the association was perfect

In the last 2 questions the most repeated words are:

- learning
- project
- team
- teammates
- implication

Based on the experience and taking into account the options of the students, it was very positive and it had a high impact on the students, though we have to consider some aspects in order to improve the experience. The main issues are time, communication with the association and creativity.

Students demand more time to develop the project. In order to do that we would have to change the model. Nowadays we dedicate 2 entire weeks to develop the technical part. This means 2 less weeks in the evaluation to teach. Perhaps the evolution would be an integrated learning in a project that lasted at least the entire evaluation, in which the teaching of the technical aspects of each module was parallel to the progress in the project.

With more time to develop the project, the second issue that students claim, communication with the association, would be solved. Sometimes, the person who plays the Product Owner role in the association does not know the real scope of that role. Some decisions had been taken by students without the consensus of the association because students cannot be attended constantly.

The last aspect reported by the students is the lack of creativity when carrying out the project. The project and the association is given to the students by teachers. One solution would be that the search for the association and the project is carried out by

the student. The search for an association with a project that motivates the student, could change the student's vision to the imposition of the project.

On the other hand, it is a real learning to work on an assigned project that is not chosen by the student. Since the end of the project and in less than a month they are working on the practices, in which they will face this situation.

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ADAPTATION IN PANDEMIC TIME OF AN INTERDISCIPLINARY ACTIVITY IN HIGHER EDUCATION FOR TEACHING MATHEMATICS IN EARLY CHILDHOOD EDUCATION THROUGH BOARD GAMES

María Pilar Ortega-Leal

Florida Universit aria, Valencia, Spain
portega@florida-uni.es

Isabel Fern andez-G omez

Florida Universit aria, Valencia, Spain
ifernandez@florida-uni.es

Marisa Mart inez-Romero

Florida Universit aria, Valencia, Spain
marisam@florida-uni.es

Abstract. Methodologies used for teaching mathematics in early childhood education are increasingly varied and put students at the center of learning. Montessori methodology, the Tekman education EMAT program, and game-based learning consider the need of playing during childhood as a basic necessity. Teachers must be prepared to use these and other new methodologies, and in their initial training, this is a task that reverts to universities. The present work shows an interdisciplinary experience developed in the third year of the Degree in Early Childhood Education carried out at Florida Universit aria. The practice started in the academic year 2016-2017 and remained active until 2021-22. The initiative emerged from the Didactics of Mathematics and Play Workshop in Early Childhood Education subjects with the collaboration of Master of Video Games' teachers. It was, therefore, an experience developed in a natural learning context because it involved implementation in schools. The initial activity consisted of developing board games related to mathematics' curricular contents for the second stage of Early Childhood Education. These games are tested by children in a school. Teachers from school and university participated in the activity's assessment, providing richer feedback. On the other hand, this experience has been affected by the pandemic. The board games' testing carried out in a school was affected by limited access to their spaces. This was a challenge for the university professors, who had to rethink the activity, which led them to opt for the Print&Play format. This new variation of the activity consists of developing games in a printable format. This version makes it possible to upload the games to the internet, providing greater possibilities for dissemination. This paper analyses the complete evolution of the experience, students' contributions to the new version of the activity, difficulties perceived by the teachers, and a new project that could arise from this experience.

Key words: *Teacher Training, Interdisciplinary Practices, Mathematics, Childhood Education, Print&Play Games.*

1. Introduction

Children have the right to play as stated in article 31 of the Convention on the Rights of the Child (1989) of the United Nations. Teachers must consider, in addition to this right, the importance of play in the teaching-learning process (Alsina, 2010). The study of contributions on play and mathematical learning in early childhood education is a

relevant topic in Europe, being indisputable for the Early Years Mathematics Group of the European Society for Research in Mathematics Education (Edo & Arts, 2016).

Different methods, among which is Montessori methodology, consider that play is present in infant's interactions with the world around him and it is an end in itself. Montessori considers play an intrinsic characteristic of the evolutionary stage and, consequently, structures the activity or materials to motivate students and lead them to active learning with specific objectives. Along the same lines, Tekman education EMAT program (<https://www.tekmaneducation.com>) uses play as a tool to practice math skills and develop collaborative learning.

The teacher's role is crucial for developing mathematical potential beyond the chosen material. Shuler & Wittmann (2009) observed that most of the teachers analyzed in their research have difficulties identifying games' mathematical potential, except for counting activities. In addition, their data analysis indicates that potentially suitable games require competent teachers in terms of didactic aspects and conversation management.

From Higher Education we have an obligation to train future teachers in teaching skills so that the promotion of play in the classroom will be feasible (Martínez-Romero, Ortega-Leal, 2021). As Ginsburg (2002) points out, "Little children cannot learn everything. But the central message is that they can learn a great deal and we don't have a clear idea of the limits on their learning yet when they are engaged in an exciting curriculum with a good teacher" (p.12).

This paper presents an experience developed at Florida Universitària in the Early Childhood Education Teaching Degree. Florida Universitària is an educational center that in its model is committed to the development of skills through active methodologies (Soto-González & Suarez, 2016). This model is transferred to the different courses given. University teachers are aware of the need to promote "learning by doing" experiences for skills development. For this reason, it innovates in its teaching through interdisciplinary activities and its implementation in real learning contexts. This paper presents the initial experience and how it, because of the pandemic, led to the development of Print&Play games.

Print&Play games are versions of board games that are not physically presented. Instead, a digital version of them is published, making it possible for players to print all or most of their components so that they can play with them wherever they are (BoardGameGeek, 2020). Normally these types of games are presented on online platforms and spread for free. Because the task of printing and assembling all its pieces falls on players, and they do not always have advanced or professional printing resources, this type of proposal is recommended for small games, with few components and learning mainly toward cards games (Łodzickowski & Jekiel 2019).

The existence of this type of game is not new, but it is true that the beginning of the pandemic marked a before and after in the number of games made available to the public in this format. Hundreds of game publishers and designers made versions of their games or their game prototypes available to the general public as a way to help and keep games reaching people (Tabletopbellhop, 2021).

2. The initial experience

The activity of *Board games and their application to mathematics in Early Childhood Education* began in the 2016-17 academic year and was carried out in its initial version until 2019-20. The activity was designed from *Didactics of Mathematics* and *Play Workshop in Early Childhood Education* subjects of the Early Childhood Education Teaching Degree with the advice and support of teachers from the *Degree in Design and Development of Video Games and Interactive Experiences*. In addition, it had the collaboration of the Public School Jaume I el Conqueridor located in Catarroja (Valencia) and Abacus³⁰. This last entity is a company specialized in teaching materials, whose role in this activity was to show students the variety of games available on the market for educational purposes.

The activity was related to the acquisition of the *General Competence 21 (CG21)* of the Early Childhood Education Teaching Degree: "To know how to work as a team with other professionals from inside and outside the center in the attention to each student, as well as in the planning of the sequences of learning and in the organization of work situations in the classroom and in the play space" (Universitat de Valencia, 2011) and with the acquisition of specific skills of the subjects (Table 1). The activity was planned to be related to practically all the specific competences of *Didactics of Mathematics* subject and with four of the competences of *Play Workshop in Early Childhood Education* subject.

The activity's objectives defined for students were:

- To know children's characteristics and needs in the second stage of early childhood education (3-6 years) about playing.
- To design, apply and evaluate board games related to mathematics.
- To develop analysis strategies for video games and board games.

Regarding the development of the activity, at first, an introductory talk on video games and board games and their relationship with the educational field was given by the teaching staff of the Video Games Degree. After that, two types of tasks were proposed to the students to delve into the subject: analysis of video games and/or board games. In relation to the analysis of video games, students in pairs visualized a series of video games and filled out a form in which they identified various aspects. Among others, if the game was educational, the storytelling and the dynamics and rules of the game. Regarding the analysis of board games, during the years in which the activity was developed in its initial version, two actions were carried out: a visit to Abacus company (specialist in educational and recreational material) and a session at Florida Universitària's library, in which students can have access to a significant number of board games. Both in Abacus and in Florida's library, students had the advice of people who were experts in board games and dynamics were carried out, so they could investigate games materials. Through these initial tasks, students delved into the board games' characteristics, their relationship with the educational field and the current commercial offer.

³⁰ <https://www.abacus.coop/es/home>

Table 1. Specific competences with which the initial activity is related

Subject: Didactics of Mathematics

CE229 To know the mathematics' curriculum for early childhood education.

CE232 To know teaching strategies to develop skills in numerical representations, spatial and geometric notions.

CE233 To know didactic strategies to promote logical development in early childhood education students.

CE234 To develop and evaluate mathematical content of the early childhood curriculum through appropriate teaching resources and promote the corresponding skills in students.

CE236 To know the difficulties and errors in mathematics teaching and learning process in early childhood education and the cognitive processes involved.

CE237 To know didactic interventions that consider the difficulties and errors in learning mathematics in early childhood education.

CE238 Analyse ICT as a teaching resource in mathematics classrooms in early childhood education.

CE239 To Know and apply innovative experiences in teaching mathematics in early childhood education.

Subject: Play Workshop in Early Childhood Education

CE109 To know how to use games as a stimulating element of development of the perceptual, motor, cognitive, social-affective, communicative and creative capacities, improving the children's self-esteem and effectiveness.

CE110 To know how to design, apply and assess leisure and motor activities for self-knowledge and environment and objects' exploration.

CE111 To know how to promote collaborative attitudes and conflict resolution through motor games.

CE113 To develop capacities of selection and information about toys and recreational materials according to needs, interests and knowledge levels.

Source: Prepared by the authors.

Once this approach to board games and video games had been made, students had to design their own board games. In this task, one of the initial actions was to identify the contents to work on in relation to mathematics, as well as other cross-cutting themes that could be incorporated (values, environmental, cultural issues...). After this, they had to define the game concept, develop the storytelling, and define the game mechanics. They were asked to develop a prototype and test it in the classroom before developing a final model. Once they had the final model, students went to Jaume I el Conqueridor Public School to test it with students in the second stage of early childhood education (5-6 years) (Figure 1). The test consisted of a play session in which children had the opportunity to play in small groups with all the board games. Florida students explained the games to each group. The experience was replicated in two classrooms. In parallel, during the play session, the evaluation of the board games was carried out. The teaching staff of the school, together with the teaching staff of Florida Universitària, carried out a quantitative and qualitative evaluation of the board games. In this evaluation, seven aspects were considered: creativity of the story, rules (clarity and coherence), materials (board game itself, cards and other kind of game's materials), educational contents that could be learned through the board game, adaptation to Early Childhood Education students (developmental characteristics), board game's evaluation criteria and dynamization of the board game within the classroom. Teachers scored each of these aspects quantitatively from 1 to 10 and provided qualitative feedback. In addition to the evaluation of the teaching staff, a peer

evaluation was carried out. In other words, in teams, students carried out a self-assessment and assessed the involvement of each participant in the design, development and implementation of the board game. This entailed an individualization of the marks. Therefore, within the same team, students could obtain different grades.



Figure 1 Play session at school.

3. Experience in pandemic times

The Covid-19 pandemic brought the need to design and implement new methodologies for online work, which also represented a challenge for teachers (Valero-Cedeño et al., 2020). In the case of this experience, part of the essential value that we gave to the project was the implementation of board games in a school. University students could have a real interaction with children of the 2nd cycle of early childhood education. However, the pandemic made impossible for university students to access to the school classrooms. On the other hand, since there were “bubble groups”, the exchange of board games between classrooms was not allowed to avoid contagion. For these reasons, we decided to review the design of the activity. From the Videogames area, it was proposed to carry out a new version of the activity and we opted for a “Print&Play” format.

The Prin&Play games, due to their intrinsic characteristics, made it easier for us to bring the production of our students closer to the school classrooms. On the one hand, its online dissemination, and not physical, allowed us to deliver the materials to schools without having physical access to the classrooms and on the other, we ended up with the problem of exchanging board games between bubble classrooms, since being printable allowed each school to have as many copies as necessary depending on the number of bubble groups and/or players. It is also a good resource for university students to have access to many board games already designed and thus be able to learn about different mechanics without incurring large expenses (Trinidad Martín et al., 2011).

From the 2020-21 academic year, the new version of the activity began under the title *Print&Play Games and its application to mathematics in Early Childhood Education*. So far, two promotions of students have participated in the experience. The activity

continues to be related to the skills mentioned in the initial activity, although university teachers consider that the promotion of ICT skills is even greater.

It was decided to maintain some of the elements of the initial activity and make modifications to the proposed tasks to adjust to the protection measures against Covid19. The initial talk about video games and board games and their relationship with the educational field remained unchanged. The visit to Florida Universitària's library continued, although each board game could only be handled by a single person. A session was held with board games provided by the students, respecting the measures adopted by Covid19 (disinfection of hands, of materials once used, use of masks...). Regarding the testing of prototypes, two types of testing were carried out. The first of them was among the students themselves in the university classroom. The second consisted of testing the game with a child close to one of the students who made up the team. It was requested to make a recording of this testing that was viewed by the students in the class to analyse the aspects of the game to be modified. The school where the activity was previously carried out could not participate due to overload in the management of tasks derived from the pandemic. Instead, the collaboration of another school was requested, the CEIP Camp de Túria located in Bétera (Valencia). The school has indicated each academic year the curricular contents in relation to mathematics, as well as a transversal theme that was being worked on at that time. Florida's students designed board games considering the school's requests.

The games, instead of being developed on physical materials (wooden or plastic boards), as in the first version of the activity, have been developed in digital format. That is, to play, materials must be printed, cut out and laminated. To facilitate the work of the collaborating school, Florida's students carried out this task. Games were provided by Florida's teachers to the collaborating school. School teachers tested the games with their students without the possibility of university's students would go to the school. Regarding the evaluation, the school's teachers gave quantitative and qualitative feedback on each one of the games. University teachers for their evaluation had this information, with the tests carried out among the students and the videos with children in the family environment. The same aspects as in the first version of the activity were evaluated, and the peer review has been maintained. Therefore, the marks remain individual.

A total of three Prin&Play games were developed during the academic year 21-22. Teacher's evaluation provided specific feedback to each group, based on the aspects indicated at the first version of the activity. In general, the quantitative results of the evaluation were very positive (average=8,85). Qualitative feedback insisted on the importance of board game's evaluation criteria and rules (clarity and coherence). Students had problems mainly in these two aspects.

4. Student results and contributions to the new learning experience

After the experience carried out in the 21-22 academic year with the *Print&Play Games activity and its application to mathematics in Early Childhood Education*, a questionnaire was applied to the students. The objective was to find out the relevance of the activity in the development of teaching skills, as well as to identify outstanding aspects and areas for improvement for future editions of the activity. The questionnaire

was created *ad hoc* and had 15 quantitative and qualitative questions. It could be divided into three parts: interest and use of games (board and video games) in their daily lives, student's evaluation of the design and development of the activity, and usefulness of the competences acquired for their future as teachers. The questionnaire was sent by email two months after the closure of the proceedings of the subject and sincerity was requested in the answers. Although there was a very small sample (9 people) they constituted 100% of the people participating in the experience. The number of students taking the course was very small and therefore the number of participants in the activity was low. All the participants made qualitative comments and contributions. Questionnaire was open for two weeks. We had to remind to the people who did not answer during the first week.

Below there is an analysis of the responses provided. The questions asked addressed students' vision of the applicability of Print&Play games to the educational field, their interest in board games and video games in their daily lives, the development of the activity and its impact on their future as teachers.

In relation to the students' vision of the use of board games in the educational field, 88.9% considered that they could be very useful (score 5 out of 5). 100% of students participating in the activity affirmed that providing teachers with Print&Play printable games can facilitate the inclusion of the game in the educational field.

Regarding students' interest in board games and video games, currently, all students play board games at least once a year. 44.4% do so at least once a month (Figure 2). None of the participants stated that they had never played board games. The frequency that board games are played on physical material is higher than the frequency of games played on digital. As we can see in Figure 3, 44.4% stated that they never play video games.

Concerning their knowledge about Print&Play format, 77.8% of the students did not know it prior to the activity. So, we can consider that the activity was the students' first experience with this type of games.

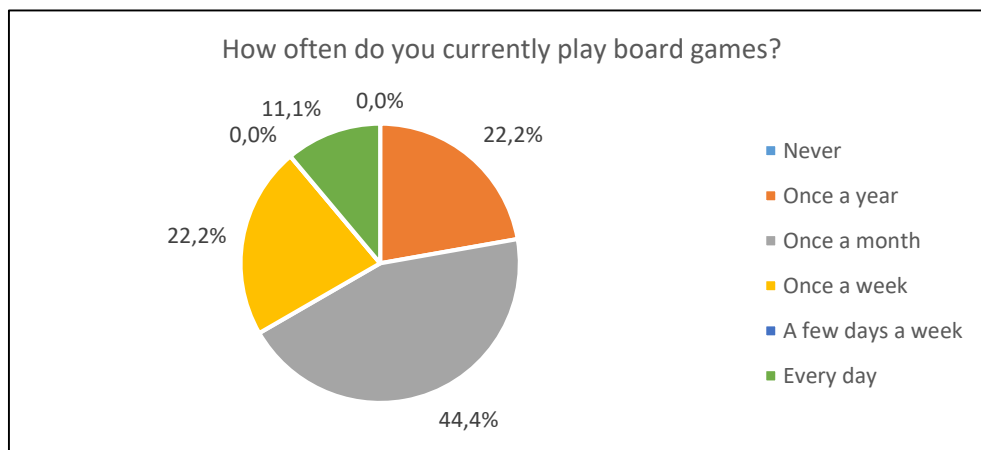


Figure 2 Frequency of play with board games

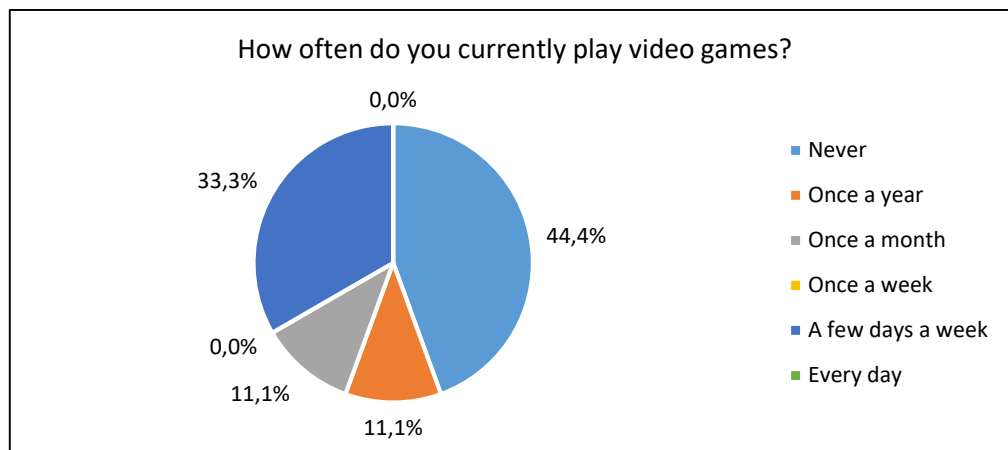


Figure 3 Frequency of play with video games

In relation to the development of the activity, a Likert scale was used (Figures 4 and 5) with options from 1 to 5 (1=not at all useful, 5=very useful). Figure 4 shows students' assessments of the training support received during the experience. The average score obtained in this question (3.11) indicates that there are aspects that could be improved. A qualitative justification was requested for this question. Students pointed out that the experience can be improved by increasing the training, detailing more children's evolutionary characteristics, through greater consistency in the feedback provided by the teachers, providing more time for the experience, better coordinating the indications between university teachers and being participants in the implementation in the school.

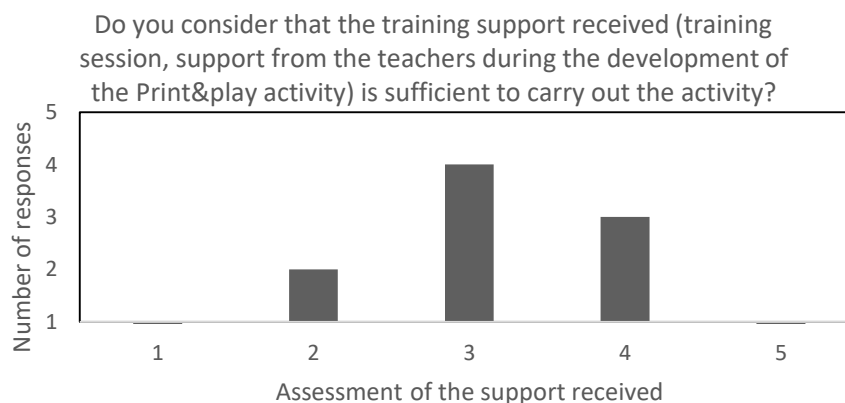


Figure 4 Assessment of the training support received during the activity.

About the development of competencies provided by the activity (Figure 5), 77.8% contribute a score between 4 and 5 points (average score of 3.88). Although this score could be improved, we consider that the impact produced by the activity is positive, since 100% of the students considered that in their future as teachers, they would use Print&Play games in their classroom.

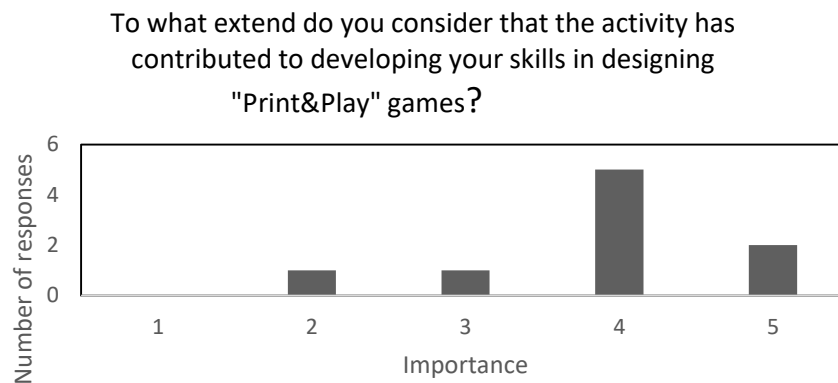


Figure 5 Competence development to design Print&Play games.

Among reasons why they would use Print&Play games in the classroom, the following was indicated: promote meaningful learning in a playful way, increase interest and motivation; promote different values such as respect and other skills such as knowing how to lose/win, strategy, competitiveness; boost learning and help consolidate content and skills; promote relationships between students through manipulative materials; and consider the importance of play during childhood. In addition, they also highlighted that the existing theoretical basis justifies the use of games in the educational field.

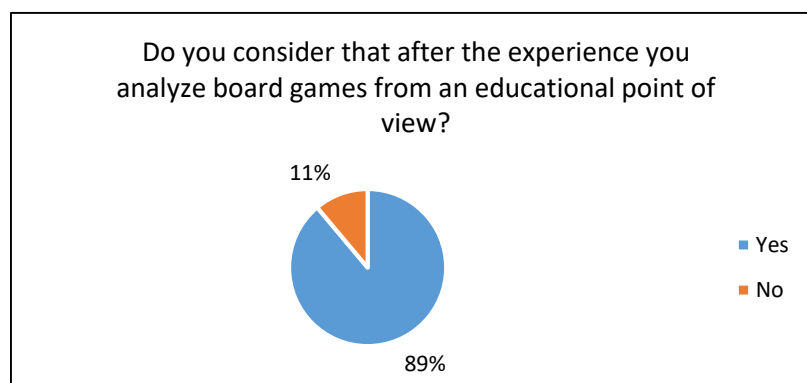


Figure 6 Impact of Print&Play experience on students' interest in analysing board games

As shown in Figure 6, 88.9% of students consider that after the experience of Print&Play activity they analyse board games from an educational point of view. Some of the reasons stated literally are the following:

"Since we carried out the Print&Play activity, every time I see a game in a store, I try to think how I could use it in class in order to know if it is a useful and versatile material or instead it is just a commercial game without more transcendence."

"Now I value in each game if the learning that child receives is really significant for him/her."

"After the training offered and the different criteria to select or make a game, you look at those details that you did not do before due to ignorance. A very relevant fact as a future teacher, since in this way you can select from set objectives."

In relation to the general highlights of the activity, students referred to the promotion of teaching skills (planning, creativity, ability to create playful materials adapted to children) and the management of the activity by the university teachers (personalized attention, impulse in the development of the activity).

Regarding general aspects of improvement of the activity, the most common comment was the need for more time to carry out the activity. This fact leads to perceptions of overload. It also alludes to the possibility that teachers of the two subjects are present at the same time to unify indications in the development of the activity. Finally, some aspects of the design of the activity are pointed out, such as the possibility that games' topic would be of free choice, that the students could participate in the implementation of the activity or that the evaluation of the schoolteacher would not be taken into account, since it has not been a participant in the development process of the game.

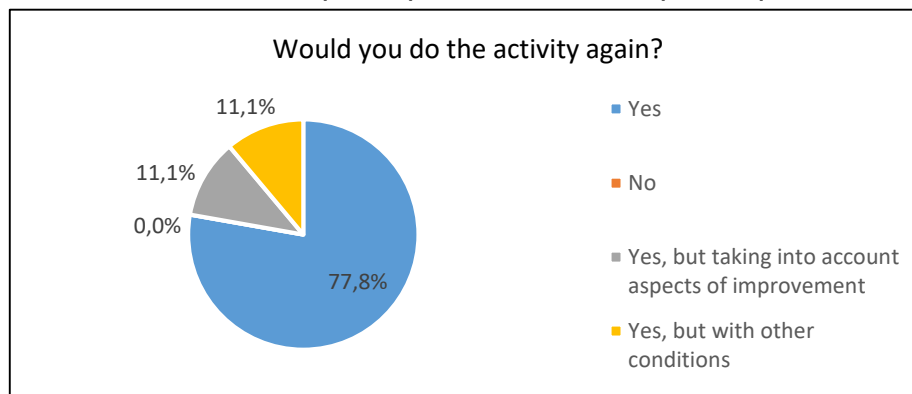


Figure 7 Evaluation of the experience afterward

All the students (100%) recommended continuing to carry out the activity with other groups. All of them (100%) would do the activity again (Figure 7). However, 22.2% consider that we should consider their recommendations for improvement. Among the comments that encourage us to continue with the activity are the following:

“This activity helps students (university students) learn about a material that can be used to work on any objective, area... as well as being very useful for working with children who have special educational needs.”

“I recommend that people do this activity so they realize the importance that board games can have in education.”

“Play is a tool that I consider essential in Early Childhood Education. It is important for the teacher to be able to create and propose innovative games that work with curriculum content in a more playful way. The trend is to opt for the traditional. The teacher must also have the ability to discriminate and differentiate between board games that provide significant learning from those that do not.”

“Everyone to play with board games! Age does not matter!”

5. Conclusions, limitations of the analysis of the experience and future work lines

This communication discusses an experience that, despite the fact that it has been in operation for six years at Florida Universitària, two in its last version, remains a challenge for university professors. We learn from the remarks of our students which

guide refinement and we also emerged reinforced with the positive comments that tell us that investing effort in this experience is worthwhile. The pandemic brought with it the rethinking of this activity. The responses of our students indicate that the Print&Play experience enables the development of teaching skills for the design and development of games. In addition, the students affirm that the activity has changed their perception and knowledge about game-like materials and their possible application to the educational field, providing them with new tools for their work in the classroom.

The lack of time is the aspect of improvement most highlighted by the students. In total, in the last edition of the activity, 22.5 teaching hours were allocated, in addition to the working time outside the classroom. This is an issue that we have tried to improve with each edition of the activity. However, the students continue to perceive that the tasks to be completed require a greater number of hours of dedication. Among the possible solutions, we have considered the involvement of another subject, an increase in the number of participants per team or that the entire group focuses its efforts on the development of a single game. For the time being, it is not possible to implement the activity in an educational centre, but we hope that the sanitary conditions improve and make it possible for the Print&Play materials to be tested on-site by the students. In addition, as they are digital materials, they can be shared on the Internet, which increases the possibilities of their subsequent use.

Among the limitations that this work presents, we want to highlight that the data provided comes from a small sample. To date, we had not formally collected information concerning the development of the activity, although it had been collected informally after its completion.

Finally, we would like to point out that in our organisation, Florida Universit aria, this experience is serving as the basis for developing a new interdisciplinary activity in which students and teachers from four university degrees will be engaged: Degree in Early Childhood Education, Degree in Mechanical Engineering, Degree in Industrial Electronics and Automation and Degree in Design and Development of Video Games and Interactive Experiences. We hope that this paper will inspire other initiatives.

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WHAT COVID-19 TOOK AWAY AND WHAT IT BROUGHT: PERCEPTIONS OF ENGLISH TEACHERS IN THEIR TEACHING BEFORE AND DURING THE PANDEMIC.

Laura María Briggs Fonseca
Florida Universit aria, Valencia, Spain
labrfo@floridauniversitaria.es.

Rosario Albert Martin-Gil
Florida Universit aria, Valencia, Spain
roalma@floridauniversitaria.es

Abstract. The Covid -19 pandemic has had a tremendous impact on education systems around the world. The closure of schools and other educational institutions has led to a restructuring of the way teachers develop their professional practice. In this context, this paper examines how the pandemic has affected English primary school teachers and provides a chronological overview of the hardships the education system faced.

A mixed-methods approach was followed. Several primary school English teachers were interviewed, and other practitioners completed a survey on methodological changes, as well as pupil assessment, families' engagement with the school and the candidates' ICT notions the teaching strategies they had used before and after they the Covid-19 lockdown. were collected.

Results seem to suggest that in the pre-COVID situation the most used teaching methods were CLIL, Project Based Learning and cooperative work. Finally, the assessment of students has varied in the different periods analyzed, where the use of rubrics, observation and assessment of assignments carried out in virtual learning environments have been predominant.

Key words: EFL (English as a Foreign Language), Covid-19, Methodologies, Primary School.

1. Introduction

The situation brought about by COVID-19 has pushed the education system to the limit and has required a series of changes in terms of methodology and learners' autonomy. This has both encouraged student autonomy and tested the performance of the strategies used by teachers in face-to-face and virtual teaching. Therefore, the methods used to structure teaching, adapting them to the new measures adopted by necessity, could continue to be useful even after the end of the pandemic (Llorens et al., 2021). Classrooms are extraordinarily complex, unpredictable, and exciting places, because they are spaces where simultaneous interactions take place (...) The interactions that take place online are much less complex, nuanced, and multidimensional (Yandell, 2020, p. 263).

Teachers had to implement different changes to make online education successful and thus motivating for students. As well as being as efficient as possible to achieve the acquisition of the competences required in the curriculum. For this reason, the present study is based on the following research questions:

RQ1. How has the application of teaching methodologies and resources evolved

throughout the periods prior to, during and after the closure caused by COVID-19?

RQ2. What have the assessment processes of the students been like before, during and after the COVID-19 induced closure?

2. Theoretical framework

This study examines how the impact of COVID-19 has affected education, particularly among foreign language teachers. The pandemic has presented many challenges throughout society and has had a historic effect on education worldwide. There is no doubt that the current situation has imposed some constraints on learning and teaching and, to some extent, has reduced the pedagogical options, with an overall tendency for educators to adapt with little prior preparation. (Patston et al., 2021).

The closure of schools has brought great challenges for the educational community as well as a redefinition of pedagogy. It has also led to a questioning of the role of the school, revealing that the acquisition of knowledge does not only occur through the intervention of teachers, but that there is knowledge that is produced within and through the interactions that are part of the experience of schooling (Yandell 2020). Education in schools, therefore, is not to be taken lightly. Teaching online is not like changing classrooms, or even performing the same activity in different situations; it is about overcoming a whole new set of challenges that are both pedagogical and technological (Williamson et al., 2020).

3. Pre-pandemic school and teacher organization

The education system has been characterised by being mainly face-to-face, with classrooms led by a teacher and with an average of 20-30 students. Furthermore, the use of virtual learning environments such as Edmodo, Google Classroom, ClassDojo or Moodle, among others, was limited.

Consequently, the situation of closure and subsequent pandemic has led to a series of changes with respect to the previous model. Firstly, the closure of schools is damaging the social interaction between the different main figures in the educational community, which is characterised by face-to-face interaction in a physical context.

Secondly, schools play an important role in feeding children, as they are one of the main sources of food, especially for pupils who may suffer from food deprivation (Masonbrink and Hurley, 2020; Poole, et al., 2021; Sharfstein and Morphew, 2020). And finally, the medical care that was available to pupils has also been absent during the time the schools have been closed (Martin and Sorensen, 2020; Masonbrink and Hurley, 2020; Sharfstein and Morphew, 2020).

Once the population was in lockdown due to the health emergency caused by COVID-19, one of the priorities was education. The first step taken was to close schools resulting in a transition from face-to-face to virtual learning. Online education is hardly a novelty for university students; so many of the companies that provide this type of content, courses, lessons, etc., decided to give away these resources for classes or lectures as part of their marketing campaign (Williamson et al., 2020).

Furthermore, UNESCO announced "The Global Coalition for Education" with the aim of reaching out to all countries and places where these resources were needed, providing an adaptable and innovative solution to the situation they faced. As

Williamson et al. (2020) report, some examples of countries that gave online platforms a chance are the UK, where the Oak National Academy and the BBC offered their own Bitsix catalogue and iPlayer content. Meanwhile, the US partnered Wide-Open Schools with Google, YouTube, Apple and Zoom. Despite the many benefits of using these platforms, they can also pose a problem, as where traditional resources were distributed across different sectors, the aforementioned platforms now dominate the field and are almost the only ones used in schools and universities. This means that all the personal data of the students who use these platforms is stored within the same companies (Hillman et al., 2021).

Meanwhile, the digital competence of learners also proves to be a relevant issue. Access to a device and connection to the network is heterogeneous, and Williamson et al. (2020) point out that the skills in use are very different and generate an area of exclusion on which measures could be taken to palliate the social inequality that existed before and after the lockdown due to the pandemic.

4. Teachers' digital competence during lockdown

The sudden change in the field of education lead us to an assess teachers' knowledge of digital competences, as the current situation has highlighted the lack of preparation and resources with regard to the application of digital technology in the classroom. In the words of Mentasti (2021, p. 304) "the pandemic has meant a real-time redesign of classroom activities and experiences that have gone from being face-to-face to exclusively virtual".

With the pandemic, educators found themselves in a situation of sudden confinement, which resulted in a lack of time to organise themselves, meaning that the teaching that began abruptly from this point onwards was not as efficient as it should have been. It took the teaching staff several weeks for the "emergency" teaching to become proficient. This led to the development of digital teaching strategies that were to involve the construction of critical thinking, that is, a way of teaching unlike what had been done in the classroom up to that point (Mentasti, 2021).

During this process, many institutions tried to carry out the same method implemented in the classroom of teaching and learning in a virtual environment, but it turned out to be ineffective for most teachers. It was also noted that in order for ICT devices and resources to become part of the pedagogical content, it depended solely on the digital skills of the individual teacher. Conducting such classes became a challenge in education, as they had to ensure that the teaching practices created were sufficiently engaging or motivating to keep students in the classroom (Mentasti, 2021).

Google Classroom became the platform of choice for teachers. The platform allows students to submit their work through different methods, such as drive or Gmail, while the teacher can create and attach announcements, assignments, upload material and assess their students. Google Classroom can be easily used on different devices by simply entering the class code created by the teacher according to Astuti and Indriani (2020). Their research in Indonesia showed that Google Classroom worked well and provided the resources in an efficient way to be used from a simple App.

5. Student perception of covid-19

Several studies have analysed the effect of the pandemic and it is along these lines

that Patston et al. (2021) talk about the importance of the creative stimulation of pupils. Their study corroborates that creativity has played a key role and can alleviate burdens, reduce personal stress, and generally enhance positive mental health meaning and outcomes, even in difficult times such as these.

According to Pascal and Bertram (2020), the pupils' narrative expressed their relief and happiness at returning to their classes, enjoying reconnecting with their friends and to being in a familiar place. In terms of changes in children's play, the patterns observed reflect pupils' experiences of Covid-19, for instance, children have been seen playing with masks or not making direct contact in the development of the games. Children clearly have a good understanding and knowledge about COVID-19 and its impact on their day-to-day lives.

In conclusion, according to García (2021) COVID-19 has generated an unexpected educational scenario in which distance education has become a reality at all educational stages. However, catering for the whole student body must remain a teaching priority. This case study examines the effect generated by a gamified proposal on third- and fourth-year primary school pupils. The study will be carried out using a mixed methodology that analyses quantitatively the pupils' participation data (n=138) and qualitatively the perception of the teacher involved through an interview. The study reveals that gamification can be a useful method to promote inclusive education, increase student participation and increase their motivation; and provides important information that can be transferred to other contexts to improve distance education experiences, ensuring attention to all students.

6. Methodology

For the development of this study, a qualitative methodology has been used, which, as Penalva and Mateo (2006) argue, is a research approach that focuses on the interest in the events, their extension and whether it is able to establish the general laws on which the study of many cases is based.

7. Participants

Throughout this study, participants have been named in order of interview, P1 (participant one), P2 (participant two), P3 (participant three) and P4 (participant three). The questionnaire is a type of standardised closed-ended interview, self-administered with closed or pre-coded questions (Penalva and Mateo, 2006). In this case, the questionnaire is made up of a complementary script to the interview questions, sent to potential English teachers who were willing to participate in the research, in which teachers answered anonymously with open-ended, numbered and choice answers.

The numbering of the questionnaires ranged from 1 to 6, with 1 being considered as little knowledge or less agreement and 6 as a great deal of knowledge on the subject or greater agreement.

This questionnaire is based on the methodology used and the different points of view of the diverse situations experienced before the arrival of COVID-19, during the quarantine and with the current exceptional situation of the lockdown.

The type of interview chosen was the standardized programmed open interview, conducted individually, in which the information was obtained orally, registering the

questions and answers by means of a consensual recording. These responses are answered freely, as the answers are not pre-coded (Penalva and Mateo, 2006).

8. Results and analysis

8.1. Results

This section will answer the research questions posed through the results obtained in the interviews and surveys carried out with primary school teachers.

RQ1. How has the application of methodologies and teaching resources evolved before, during and after the lockdown caused by the covid 19?

Pre-lockdown

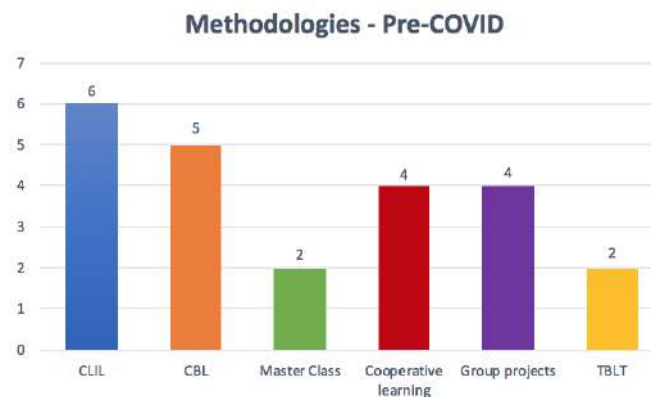


Figure 1. Graph of question number 7 on the methodology used prior to COVID-19.

One of the aspects in which the pandemic has had the greatest impact on education is the methodology used by teachers. The current situation has forced many teachers to modify their teaching techniques in order to adapt to the new normal.

The first part deals with the organization of the sessions before confinement. As can be seen in Figure 1, most of the interviewees agree on the use of CLIL (Content and Language Integrated Learning) as their preferred educational model.

The second most used methodologies are project-based learning and cooperative work. This is followed by group work and TBLT (Task-Based Language Teaching). The least used method according to the survey is lectures.

We also wanted to know whether, in addition to the methodologies, the people who took the survey used other methods or ways of organising their sessions. The answers obtained were Gamification or game-based learning, active methodologies and TPR (Total Physical Response). As participant number four (PI4) points out, in addition to resources, it is necessary to have a good organisation: "To keep up to date it is very important to schedule. (...) It is also important that, when you programme, you don't always stick to a book publisher, even if it is more comfortable to work with publishers".

In relation of the technology used, many respondents stated that they had access to computers, tablets or projectors in the classroom and therefore made use of a wide variety of audio-visual resources. Other tools mentioned were Genially, Google apps

or Chrome and Realia.

The results obtained on the rating of technological literacy before the pandemic indicate that teachers already had technological resources in their classrooms and made extensive use of them.

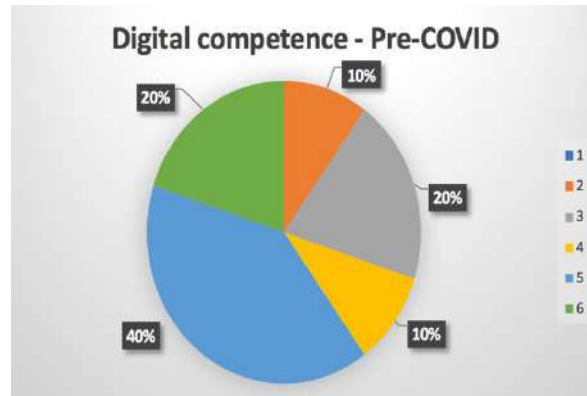


Figure 2. Graph of the degree of self-perceived digital competence pre-COVID

The average score is 4.4. As can be seen in Figure 2, of the 10 respondents, 3 of them say that their technological knowledge was very high, 5 of them agree that it was quite high and the rest say that they had some technological knowledge, but not enough. However, as it will be seen in the following section, it was during the confinement that there was a significant change in this aspect.

Lockdown

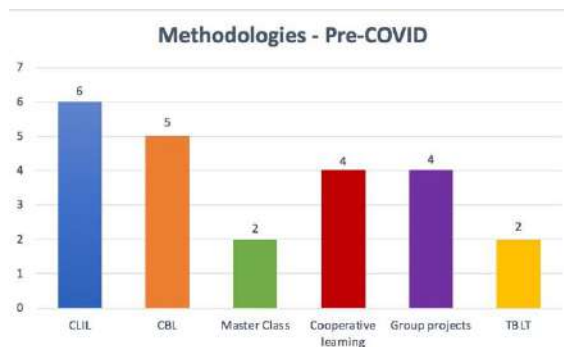


Figure 3. Graph on the methodologies used during lockdown.

Secondly, we will deal with the results obtained during the confinement, most of the respondents answered that CLIL followed by Project Based Learning (PBL) and Cooperative Learning are the most used methodologies. Based on the interviews, other answers are observed, for example participant number five (PI5): "What I did in English was, on a weekly or fortnightly basis, to upload proposals for activities such as: songs of routines, interactive games pages, video stories for parents to watch with them".

The second question is closely related to the previous one, it focuses on other methodologies used by teachers during the confinement. As the survey shows,

teachers have given other options such as Gamification, TPR or the Multimodality Approach (multimodal approach), the latter being different to those used prior to the lock-in. As stated by participant number four (PI4):

"The most ideal thing for the children was to maintain direct contact, either by video calls or direct videos. In my case, I chose to record screenings of my classes at home (...) I left my class recorded at home from my screen (...) In this way everyone connected at the time they wanted, downloaded their stuff onto Google Drive, that is, the platform they were using at the time, and visualized the activities that I was doing".

The next question is based on the technologies and the use and knowledge of websites and devices that were used during the confinement. Most of the respondents used computers, teaching websites, design websites (Genially, Plickers...) and tablets. Similar answers were received in the interviews, as participant number seven points out (PI7): "We do a lot of cooperative work, and we upload things to Classroom. (Google Classroom), an online platform to upload content so that families can see it."

Related to technology, participants were also asked about their level of digital competences during lockdown, and the average response was 4.5, coinciding with the pre-COVID situation. According to participant number four (PI4): "Of course, when everything happened it was very difficult for all teachers, especially those teachers who don't have ICT skills".

Post-lockdown

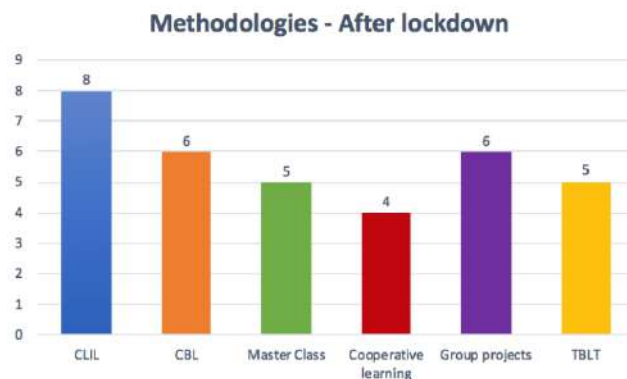


Figure 4. Graph of question number 18 on the methodology used after lockdown.

As far as the current situation is concerned, and as Figure 4 shows, the surveyed teachers maintain their preference for CLIL as an educational model. There is an increase in the use of master classes, while the other methodologies continue to be used equally by teachers at all stages.

The success of the use of teaching methods, as some interviewees commented, is due to the ability of learners to adapt despite adversities. As participant six (PI6) mentions: "They are great, they are super adaptable (...) at the beginning it was a bit difficult for them, especially because we divided the class in two (...) it was a shock for them not to be able to play with the others."

Participants were asked about the use of other methodologies and many of them agreed on the use of Gamification or a multimodal game-based learning approach as a complementary methodological tool.

Subsequently, they were also asked about the technological resources currently used by the respondents. They continue using platforms and also agreed on the use of applications such as Kahoot or Bamboozle in a playful approach to knowledge. Various presentation design platforms or templates such as Genially or Canva were also mentioned.

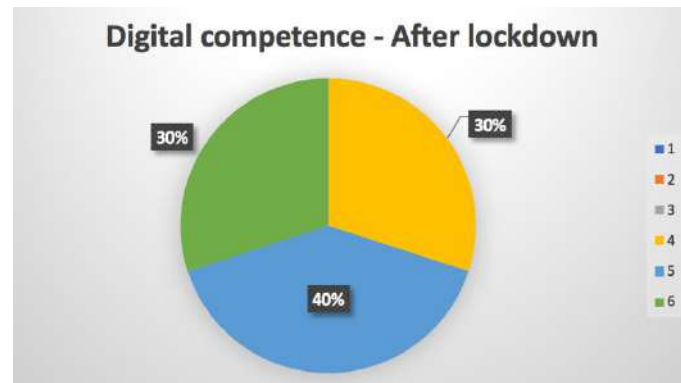


Figure 5. Graph of the degree of self perceived digital competence after lockdown.

On the basis of the ICT used, we asked about their level of knowledge in this field, obtaining an average of 5 out of 6, as can be seen in figure 5. All the teachers surveyed agree that they now have greater digital competence.

RQ2. How have the student evaluation processes been before, during and after the confinement caused by covid-19?

Pre-lockdown

An enquiry was made as to how students were assessed with regard to their acquired knowledge. The responses were very diverse, with many respondents agreeing on the use of rubrics or observation. Others were in favour of exams consisting of different parts: Writing, Listening and Reading. There were also those who gave marks for oral interventions and active participation, as well as class work or activities. Very similar comments were obtained from the interviewees, as participant four (PI4) explains: "I would always, or nearly always, use an "audio-lingual method" (...) I chose this method because I expose them to the language a lot, I give them a lot of input"

Lockdown

Regarding the confinement situation, the survey obtained diverse responses in relation to student assessment, such as the use of rubrics, observation, exams, participation, tests, video calls, the use of worksheets or online work. Overall, however, assessment remained broadly similar to what had been carried out up to that point.

Post-lockdown

As for the current situation, it was asked whether the form of assessment had changed due to the challenging situation. The development of tests as a model for assessment

was highlighted. It was also commented that observation or results and participation in assignments were part of the overall grade. The use of feedback from learning platforms as part of student assessment was mentioned as a new element.

8.2. Analysis

As far as RQ1 is concerned, in the pre-COVID situation it has been observed that the methodology most frequently used by teachers was CLIL, which, as the questionnaire shows, is becoming more and more common among foreign language teachers, alongside Project Based Learning and cooperative or group work. Since lockdown up until now, the methodologies have continued to be used, however, teachers had to adapt to the extraordinary situation, so they resorted to the use of different teaching techniques such as: TPR, Multimodality approach or Gamification.

The current situation has forced many teachers to modify their teaching techniques in order to adapt to the new normal and ensure the safety of both students and them. Surveys show that there has been an increase in the practice of master classes due to the restrictions that have to be implemented in schools. Despite this, teachers have managed to maintain teamwork and projects, as well as cooperative learning, as shown in the study by Mentasti (2021).

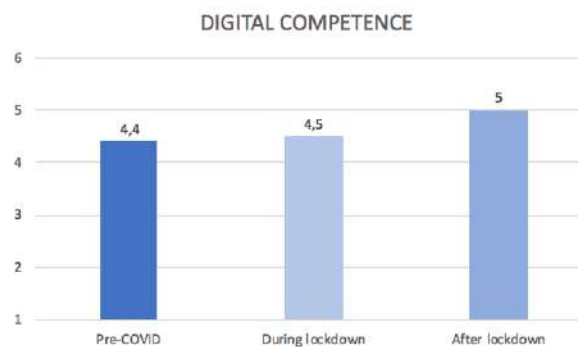


Figure 6. Comparative graph on self-perception of digital competence

The results show (Figure 6) that teachers' digital competence has not increased significantly before the closure compared to the current situation. Nevertheless, teachers consider that their knowledge and training in ICT tools has improved throughout the process.

In relation to RQ2, student assessment has varied considerably in the different periods analysed. Firstly, prior to COVID-19, examinations, oral interventions, active participation or rubrics through observation were mostly used. As for the lockdown period, teachers had to adjust themselves and although they did not abandon some of the methods already mentioned (rubrics, observation or active participation), they were compelled to include new techniques such as video calls, the use of worksheets or online work. Finally, in the post-COVID or current situation, in addition to the aforementioned tools, information is being obtained from teaching platforms.

On the whole, it is worth highlighting the possible prospective of this study. On the one hand, the same survey could be carried out in other educational stages (Highschool, A levels, University Degrees, Training Cycles...) with the participation of different teachers who deal with different methodologies and assessment methods. On the other hand, more experienced teachers, families, and students could be interviewed to

obtain a different point of view. In addition, the current situation could be analysed by means of on-site observation in a school. Provided that health regulations allow it.

9. Conclusions

It is undeniable that COVID-19 has put education to the test and that despite the hardships, the educational community has managed to emerge from it and learn from the process. Schools, teachers, students themselves as well as the educational community in general have been compelled to adapt to a new and unfamiliar situation. Education has undergone a transformation, which has implied a change in methodology, organisation and distribution of classrooms, student assessment and communication with families, among others.

The aim of this study was to find out and compare the performance of primary school foreign language teachers in the face of the adversities caused by the health crisis. Thanks to the interviews conducted and the information obtained from the questionnaire, it was possible to gain first-hand knowledge of how the pandemic was experienced in the classroom.

The results show that the lockdown period required the change of didactic models, as the need to conduct online classes implied some limitations, but also encouraged the inclusion of new resources. One of these were the digital platforms that played a key role in the new educational modality, taking a further step towards digitization. While in this same situation, student assessment was carried out in a more traditional way and communication with families was the norm.

All in all, despite the critical and difficult situation and the consequences it has entailed, the schools have been able to rise to the challenge and the teaching staff, in this case primary foreign language teachers, have been able to adapt and overcome the adversities. After a year of pandemic, schools are more than used to this new situation.

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Track 5

Videogames

JUNIOR RESEARCHER'S PAPERS

USING VR TO IMPROVE PHOBIAS' TREATMENT

Francisco Carrasco-Girbés

Florida Universitària, Catarroja, Spain
frcagi@floridauniversitaria.es

Carlos González

Game technologies and Applications, Florida Universitària, Catarroja, Spain
cgonzalez@florida-uni.es

José Luis Soler-Domínguez

Game technologies and Applications, Florida Universitària, Catarroja, Spain
jlsoler@florida-uni.es

Abstract. Virtual reality allows users to experience aspects of real life in a controlled environment, giving them the feeling of being protected as their body is not "in danger". It is therefore a great technology to expose people suffering from phobias (Witte et al., 2020), (Pouliadou, 2017) (Hilty et al., 2020). According to some studies, even a real exposure shows a high efficacy, people often prefer VR treatment to exposure to their fears, rather than therapy (Zimmer et al., 2021). The main objective of this project is to study the evolution and their progress treating their phobia. To do this, we created a VR project where from the exposure we gather important information such as age, gender, phobia level sent to a backend that stores it in a database where it will be treated and analyzed.

This project consists of an immersive experience in VR, in which users have the possibility to face their agoraphobia with the level of exposure required from the patient with the possibility to be scaled along the session by the psychologist from the companion App that he/she will be using. All the information collected will provide us with relevant information to determine the level of anxiety of the users when facing their fears, carrying out case studies to improve this type of experience. This project has been developed to be used with Oculus, but with the possibility of being integrated with other devices.

Key words: *Virtual reality, phobias*

1. Introduction

Exposure therapy is considered the main treatment for anxiety disorders such as phobias, confronting them in face-to-face or virtual environments (Hofmann & Smith, 2008), (Norton & Prince, 2007), and aims to help patients overcome their disorder by creating a safe environment in which they are exposed to their fears. Although studies report similar efficacy (Zimmer et al., 2021), people often prefer to perform these exposures to their fears in a virtual and controlled environment.

Nowadays technical innovations are making great advances in all aspects of our lives, and thanks to virtual therapy, which can help to treat phobias, this project can be a great opportunity to contribute to psychotherapy treatments.

The main goal of this project is to focus on agoraphobia, but with the possibility to scale it also to arachnophobia or other phobias, as they are two of the most suffered phobias and they are aspects of everyday life (The Recovery Village & Abby Doty, 2022).

So to represent these aspects we decided to create realistic experiences that people can live in their daily lives, such as meetings, with a large number of people, so that they can expose themselves without feeling in danger, as they face them in a more protected environment.

Although our main objective in this project is not to cure these anxiety disorders, as we are not specialists in this subject, we want to help those specialists by having a tool to help their patients.

Our intention in this project is to collect information from different cases, being able to make demographic maps that can help to investigate new methods to support or cope with all these disorders, and to have all this information treated in a database.

For all the above, we developed an immersive experience project in Unity for VR devices. In this project the player will choose the level of fear and anxiety he/she wants to feel during a session.

All this data will be sent to a backend. This backend has been implemented in PHP, and MySQL locally, but the intention is to upload it to a server, for example AWS to be used worldwide, and to be able to download these demographic maps (Figure 1 System architecture).

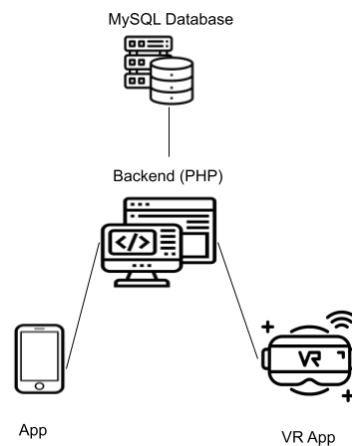


Figure 1 Architecture Diagram

2. State of Art

There is great interest in maximizing the effectiveness of exposure therapy for phobias (Raeder et al., 2020). And exposure is considered the main treatment for all these disorders, aimed at helping patients overcome their phobias in a realistic controlled but virtual environment, as well as for the protection of the patient (Hofmann & Smith, 2008), (Norton & Prince, 2007).

In addition, this helps those who have problems imagining or visualizing specific feared stimuli (Maples-Keller et al., 2018).

Although live exposure therapy is highly effective, many people do not seek this type of therapy as virtual elements have been shown to be more tolerated, and have similar efficacy (Zimmer et al., 2021).

Virtual reality aims to parallel reality by creating a world that can be immersive and interactive at the same time (Rizzo et al., 1997). Users fully experience VR when they believe that the paradigm simulates the real world with a high degree of similarity.

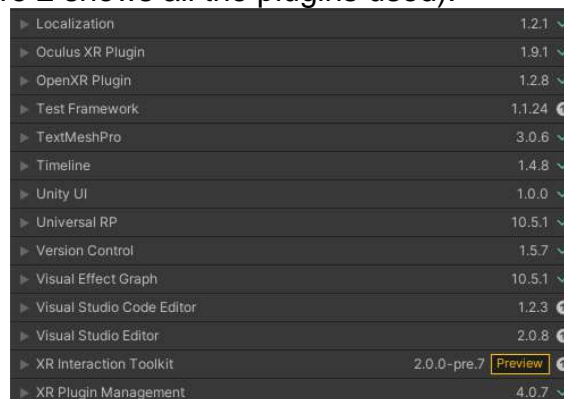
The sense of presence, or rather, of feeling physically present and accepting reality at a subconscious level in VR, is facilitated by the use of technologies such as head-mounted displays, gesture-sensing gloves, sound, etc. In addition, some VR paradigms are programmed to react to the user's actions (Anderson et al., 2001).

Clinical psychology describes phobia as an anxiety disorder characterized by intense irrational fears. This excessive amount of fear does not correspond to the potential amount of danger (Grenier et al., 2014).

We think that certain data, such as age, gender, HRV can be taken and can give us important information to make such demographic studies (Rahani et al., 2018).

3. Method

This work presents an immersive experience to treat phobias in VR, the main objective of this project is to help psychologists to have a tool that can help their patients: For this purpose, a virtual environment has been created that simulates scenarios for agoraphobic people. In addition, this project has its backend, which will help to collect information and escalate anxiety for the patient from a mobile application, which will be controlled by the psychologist. It has been developed in Unity, version 2020.3.10. Making use of different plugins such as XR Interaction Toolkit, Oculus plugin, Localization, etc (Figure 2 shows all the plugins used).



Localization	1.2.1	✓
Oculus XR Plugin	1.9.1	✓
OpenXR Plugin	1.2.8	✓
Test Framework	1.1.24	⊕
TextMeshPro	3.0.6	✓
Timeline	1.4.8	✓
Unity UI	1.0.0	✓
Universal RP	10.5.1	✓
Version Control	1.5.7	✓
Visual Effect Graph	10.5.1	✓
Visual Studio Code Editor	1.2.3	⊕
Visual Studio Editor	2.0.8	⊕
XR Interaction Toolkit	2.0.0-pre.7	Preview ⊕
XR Plugin Management	4.0.7	✓

Figure 2 Plugins installed

As we think it is also quite important to make this project understandable for most people, we decided to install localisation, so at the moment this application allows users to choose between English and Spanish, with the possibility to extend it to more languages like French, Italian, etc. The plugin used for interaction is XR Interaction toolkit, making use of XR RIG (figure 3), oculus hand models, XR, Ray Interaction for UI, a ray is shown if the hand points to the UI elements.



Figure 3 XR RIG (Patient)

In this project the user simulates his visit to the psychologist for his therapy session. (Figure 4)

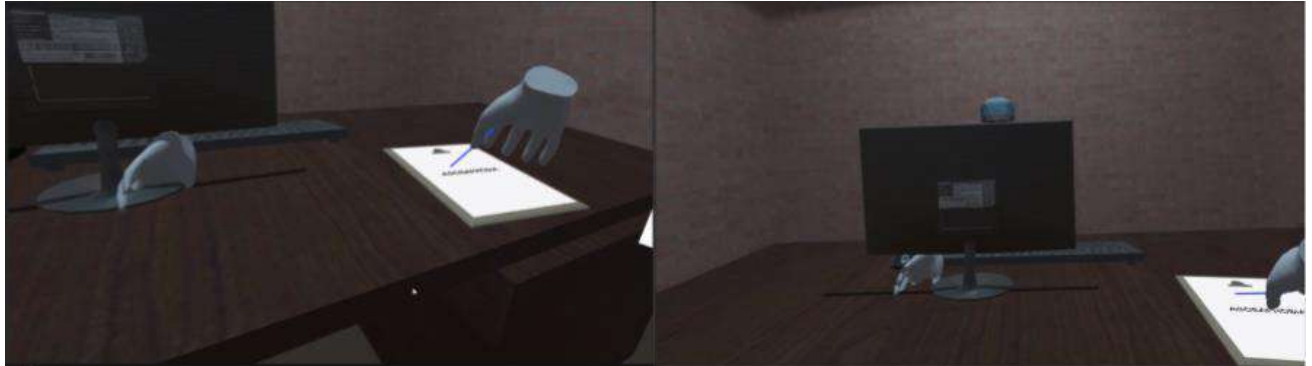


Figure 4 Psychologist consult (Lobby)

For this work, patients will be confronted with agoraphobia, this phobia causes an intense fear of feeling overwhelmed, unable to escape or to get help, and people suffering from this phobia usually avoid situations such as open or closed spaces, crowds, public transport, etc. (Cleveland Clinic, n.d.).

Between the scenes all interactions will be detailed with images and text, showing the possibilities within the environments.

- The level of phobia will be chosen by the psychologist.
- Depending on your level of anxiety different actions in the treatment will take place. For example, more people in the meeting, people talking loudly, etc. (Figure 5 Two different levels of exposure to agoraphobia).



Figure 5 Agoraphobia session with 2 different anxiety level

The psychologist will choose from a mobile application, what will happen during the treatment:

- Add more people
- Open the door
- Make the room bigger.
- Move the character to an outside environment.

At the end of the session the patient will fill in a form, being sent in JSON format to the backend, where he/she will be treated.

This backend has been implemented using a local server such as xampp using Apache server, and MySQL database, PhpMyAdmin, provider for now.

The backend has been implemented with PHP, in Visual Studio Code.

During the session, this backend will receive data from a mobile app that has been developed and that the psychologists will use, adjusting the therapy for the patients and modifying the environment almost instantly.

Once the backend has received the JSON data, it decrypts it, formats it into the values we want to store and inserts it into the database. (In Figure 6 you can see a function that manages the data to be sent to the database).

```
function SetValues($sessionDecrypted){
    //Assign Values
    $genre = $sessionDecrypted -> genre;
    $age = $sessionDecrypted -> age;
    $phobiaLevel = $sessionDecrypted -> phobiaLevel;
    $symptoms = $sessionDecrypted -> symptoms;
    $HRV = $sessionDecrypted -> HRV;
    $duration = $sessionDecrypted -> durationSession;
    $date = .date("dd-M-YY H:i:s");
}
```

Figure 6 Database Structure

Our database (Figure 7 Database structure) has a single table containing all the collected information, this database is configured to have all the required information, for example trying not to send empty or null data (Figure 8 Example of a simple query, obtaining a row of collected information).

#	Nombre	Tipo	Cotejamiento	Atributos	Nulo	Predeterminado
<input type="checkbox"/>	1 id	int(255)			No	Ninguna
<input checked="" type="checkbox"/>	2 genre	varchar(255)	utf8_spanish2_ci		No	Ninguna
<input type="checkbox"/>	3 age	int(3)			No	Ninguna
<input type="checkbox"/>	4 userLocation	varchar(255)	utf8_spanish2_ci		No	Ninguna
<input type="checkbox"/>	5 phobiaLevel	int(1)			No	Ninguna
<input type="checkbox"/>	6 symptoms	varchar(255)	utf8_spanish2_ci		No	Ninguna
<input type="checkbox"/>	7 HRV	float			Sí	NULL
<input type="checkbox"/>	8 duration	float			Sí	NULL
<input type="checkbox"/>	9 date	datetime			No	current_timestamp()

id	genre	age	userLocation	phobiaLevel	symptoms	HRV	duration	date
1	Male	26	Valencia, Spain	4	very nervous, not able to move that much, strange	123.5	32.56	2022-03-28 18:26:17

Figure 7 Database Structure

Figure 8 Example of a Query from database

4. Conclusions

In this paper we present an immersive experience with a different approach on how projects for the treatment of phobias could be developed, helping psychologists to have another tool to expose their patients to phobias in a controlled environment.

The road to a complete tool to cure these disorders is still quite long, but with technological advances and the development of more tools, it gives hope for the future.

Our main goal with this project is to offer a good tool that psychologists or other developers can use to help more people by using it, demanding other phobias or implementing better features discovered in the future.

In this work we have developed an approach to the tool for the treatment of phobia with a focus on agoraphobia.

As further work this project could expand to other phobias and finish the implementation done on Agoraphobia, receive feedback and some participants to get cases, and make the right decisions to change what is necessary to maximize the therapy applied in this project. As well finding potential patients that can test it and truly give us feedback about their experience.

More changes to be made are set in the backend making it more secure, trying to avoid false data to skip security, encrypt and decrypt the data, being able to generate and download pdf file, with graphs getting the data from the database, that will help to make demographic studies investigating how to treat these anxieties in more detail, depending on selected ranges with required parameters to the psychologist, with simple queries to the database.

To finalize this backend the last task will be to upload it to a web server such as AWS so that it is accessible globally and not just locally.

Although there are things that have been delayed for now, we are working on them so that in the future it will be a great functionality to be able to receive HRV data from smartwatches, fitbits, etc.

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THE ART OF GAME DESIGN: A FOCUS ON WOMEN IN THE VIDEO GAME INDUSTRY

Andrea Schöniger

Florida Universitària, Valencia, Spain
anscti@floridauniversitaria.es

Carlos González

Game technologies and Applications, Florida Universitària, Valencia, Spain
cgonzalez@florida-uni.es

José Luis Soler-Domínguez

Game technologies and Applications, Florida Universitària, Valencia, Spain
jsoler@florida-uni.es

Vicent Ramírez

Florida Universitària, Valencia, Spain
vramirez@florida-uni.es

Abstract. Humanity has always been driven by creativity, an aptitude unique to our species that allows us to seek new ways to solve problems. Boredom is no exception, as our mind has always sought an activity to entertain itself, thus the need to play was born. This innate need has been reflected throughout history from the first board games to the latest technological advances, such as Virtual Reality. The study of games inevitably arises to make playing attractive, entertaining and even educational and immersive. This study is known as game design, which despite still being unexplored, more and more researchers are joining the research of the complexity of the human mind and its deep relationship with games. Unfortunately, as it happened in other sectors originally considered "for men", there have been countless cases of women who have remained in the shadows after having made great advances in the videogame industry. The fact that videogames have always been considered masculine products has acted as a blindfold on women who do not even consider studying or dedicating themselves to them. We must not forget that the ability to make a good video game, beyond the tireless study of a constantly growing industry, consists of effort, affection, and dedication, which have no relation to gender. This paper covers the history of the art of game design, which is intended to give visibility to women who make up the industry and thus encourage other women to be part of the growing community of game development.

Key words: *video games, women, industry, gamers, game design, history, art*

1. Introduction

The video game business has been both a new medium for art and invention and a major driving force in the evolution of various technologies since its inception. In its brief existence, the video game industry has grown from a hobby to a multi-billion dollar industry. People of all ages and genders are playing video games in greater numbers than ever before. It's an exciting time for the industry, with so many new gamers and growing technologies.

Women are part of its history. They have shaped this industry via hard effort, inventive coding, artistic imagination, and commercial savvy, from the assembly line to the marketing department. Please, take into consideration that whenever reference is made to women, it is also intend to include cis women, trans women, and non-binary people.

1.1 Motivation and objective

This article intends to study the history of the art of game design in order to highlight the contributions of women to the industry and inspire other women to join the growing community of game development.

2. State of art

2.1 Origin of video games

Humanity has always been driven by creativity, an aptitude unique to our species that allows us to seek new ways to solve problems. Boredom is no exception (Toohey, 2011), as our minds have always craved activity to entertain us, as is the case with dreams; stories that only we humans have tried so hard to bring to life and transmit to the rest of the world. Entertainment is an innate need that has been reflected throughout history, from the first games, whose tools were mainly composed of bone, shells, stones and sticks, to the creation of the video game, which together with the latest technological advances, bring us closer and closer to living these stories.

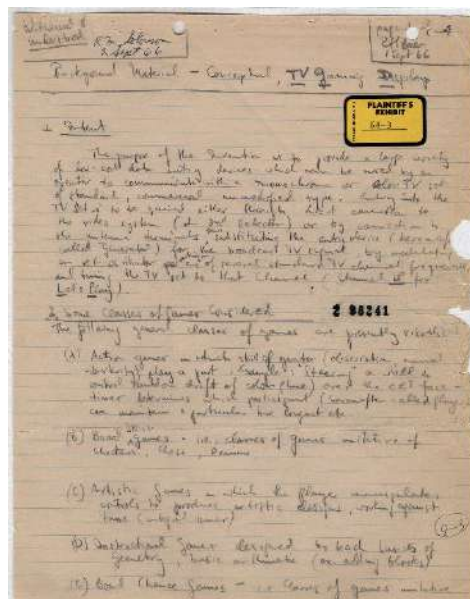


Figure 1 The first page of Baer's concept document for interactive games on television (1966). Ralph H. Baer Papers, AC0854, Archives Center, National Museum of American History, Smithsonian Institution.

In 1947, Thomas T. Goldsmith and Estle Ray Mann designed the *CRT Amusement Device* (Wolf, 2012), capable of drawing lines to simulate missile shots at an on-screen element. Shortly thereafter, in 1951, Ralph H. Baer studied the way to manipulate the television image to make it interactive (Bedi, 2019) (*Figure 1*).

Sadly, the video game would have been born years earlier if any of these ideas had seen the light of day, but its contractors and investors were unable to find its potential. Finally, in 1958, William Higginbotham developed *Tennis for Two*, which by definition could be considered the world's first video game (John Anderson, 1983), in which two players with individual controllers send a beam of light from one end of the screen to the other. It would take almost 13 years for video games to become a commercial product with the first arcade video game *Computer Space* by Nolan Bushnell and Ted Dabney in 1971.

The story of great men establishing an industry one game at a time is commonly repeated in video game history, unfortunately, as in other traditionally male-dominated industries, there have been several stories of women who have remained in the shadows despite making significant advances in the gaming industry. Women like Carol Shaw, known for her work at Activision on the vintage classic *River Raid*, but she had already established herself in the history of video games years before, being the first woman to develop and design a video game for the Atari 2600, *3D Tic-Tac-Toe*, in 1978 (Cohen, 2020).

Roberta Williams is one of the most influential figures in video game history. After playing a text-only computer game, Williams was inspired and developed *Mystery House* in 1979 with her husband Ken. It was a huge success and marked the birth of graphic adventure games. Williams was recognized with more than 30 outstanding computer games by the time she retired in 1996, the most of which she wrote and designed, including *Kings Quest* and *Phantasmagoria* (Cohen, 2020).

Muriel Tramis used her French-Creole roots to investigate the ghosts of slavery on the island of Martinique in her 1987 debut title *Méwilo*, making her the first Black woman to commercially make video games. The Parisian Department of Culture awarded her a silver medal for her efforts.

Reiko Kodama was one of the first women to work as a video game artist. After drawing characters for Sega arcade games, she produced the art and characters for the 1987 renowned role-playing game *Phantasy Star*, a science fiction-inspired game starring a tough, revenge-seeking female protagonist Alis.

Many women worked on factory floors putting games together, testing them, and packaging them. Others worked in company back offices in the 1980s, investigating player preferences. Colette Weil was hired by Atari in 1977 to perfect the market research methodologies pioneered by her predecessor Carol Kantor. Weil's master's thesis from 1980 was the first to look into the motivations of both male and female arcade game players (*Figure 2*).

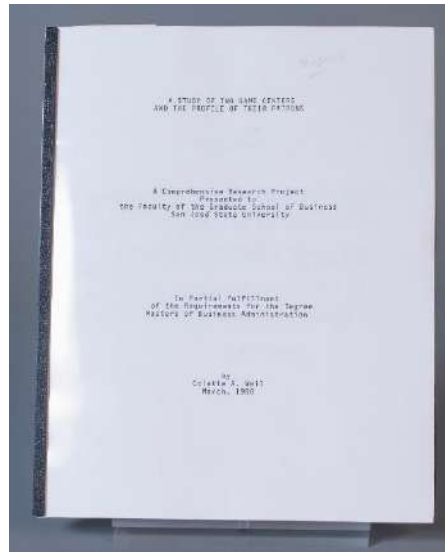


Figure 2 Colette Weil MBA Thesis: "A Study of Two Game Centers and the Profile of their Patrons" (1980). The Strong National Museum of Play, Rochester, United States.

Mary Fujihara worked alongside Linda Adam as a marketing assistant at Atari. They assisted in the creation of the industry's first game user research program, which conducted innumerable focus groups and surveys to better understand gamers (The Strong National Museum of Play, 2018) (*Figure 3*).

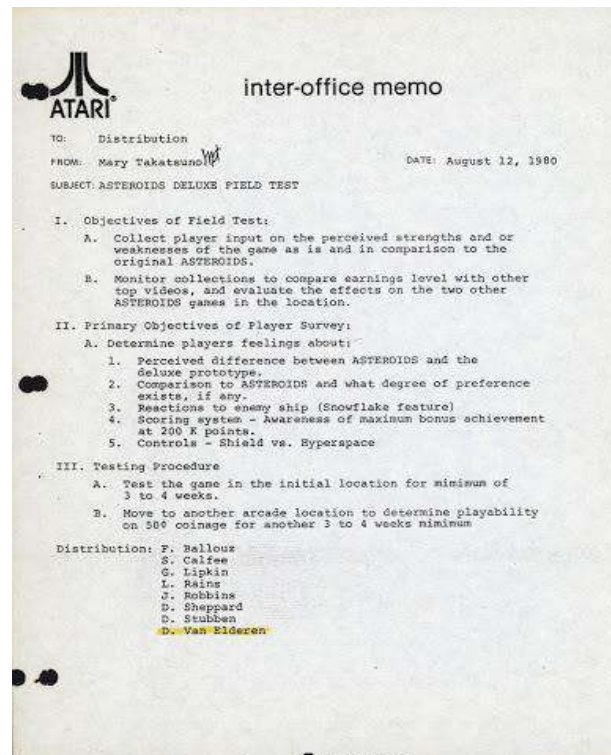


Figure 3 Inter-Office memo from Mary Takatsuno re: *Asteroids Deluxe Field Test* (1980). The Strong National Museum of Play, Rochester, United States

Decades later, the study of games inevitably arises to make the game engaging, entertaining and even educational and immersive. This study is known as game design, which despite being still unexplored, more and more researchers are joining the investigation of the complexity of the human mind and its deep relationship with games, the phenomenon we call "game experience".

Thanks to this field of study, the term "video game" has evolved over the decades from a purely technical definition to a general concept that defines a new kind of interactive entertainment, from the use of abstract elements that demanded a considerable effort of interpretation from the player's brain to the current degree of realism that greatly facilitates its immersion in the game.

2.2 Women in the video games industry

In the early days of video games, many have been based on sexist plots, such as the *Leisure Suit Larry* saga created in 1987 by Al Lowe, and gender violence, such as *Custer's Revenge*, produced by Mystique Company in 1982 (Díez Gutiérrez, 2014). This kind of content is still being developed disguised in modern games such as the famed *Grand Theft Auto* saga.

Thus, video games are still considered by many a masculine product, which is reflected in the hypersexualized designs of numerous female characters in renowned video games, such as Quiet in *Metal Gear Solid V: The Phantom Pain* or Isabella "Ivy" Valentine in *Soulcalibur*. Female characters also tend to have secondary and unimportant storylines or are simply depicted as damsels in distress (Dietz, 1998).

For this reason, many women do not even consider studying or dedicating themselves to video games because they are blinded by the fact that video games have long been regarded and developed as masculine products. The lack of female representation in the industry feeds back into the development of content aimed at male audiences, creating an endless cycle.

In 2021, a survey published by the International Game Developers Association (IGDA) found that 61% of responding game developers were men, while 30% were women. Approximately 8% did not identify as either men or women (Weststar, 2021) (*Figure 4*). We can appreciate that every year there are more and more women who dedicate themselves to developing video games professionally, but there is still a long way to go.

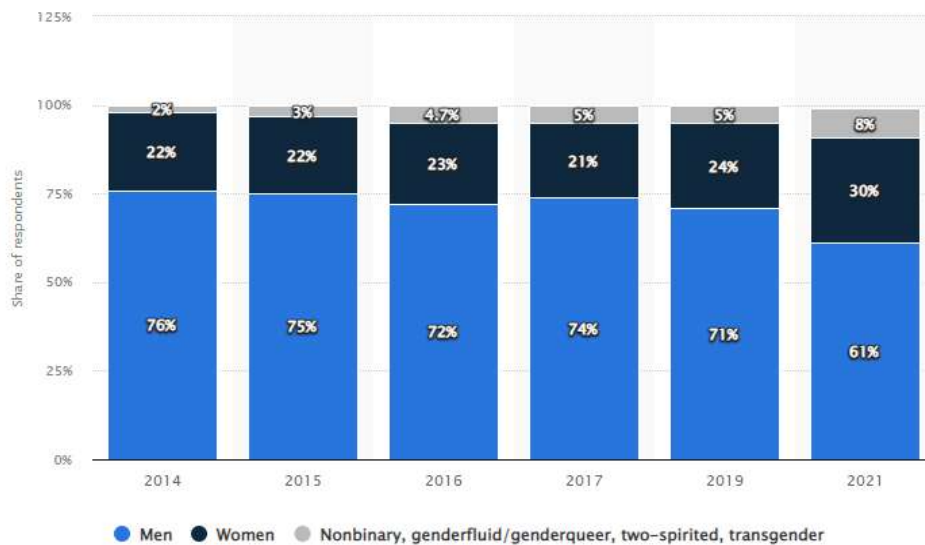


Figure 4 Distribution of game developers worldwide from 2014 to 2021, by gender. Survey by IGDA. Published by J. Clement on Statista.

Many cases of inequality have been reported by women within the video game industry. There are organizations that are aware of this gender discrimination and are fighting for change and equality. Women in Games, formerly known as Women in Games Jobs (WIGJ) is a UK-based not-for-profit organisation founded in 2009 by David Smith, who recognised the need for more support for women working in the sector. There is also FemDevs, a Spain-based non-profit association that aims to promote the interest, participation and presence of women in the video game development culture.

This paper highlights some of the many women who are making a mark on the video game industry in their own unique way and whose stories are still unfolding.

Amy Hennig is a game director and writer whose cinematic writing and creative direction have defined a generation. She has worked on a number of critically praised games, including the *Uncharted* franchise, the *Legacy of Kain* franchise, and *Jak and Daxter*. She is now regarded as one of the industry's most influential women (Bay, 2020)

Brenda Romero is a multi-award-winning game designer who started her career in the video game industry in 1981. She is best known for her work on the *Wizardry* role-playing game series and, more recently, *The Mechanic is the Message* series of six board games. *Train* is one of them. The challenge she set for herself was to use game mechanics to capture and express difficult emotions (Takahashi, 2013).

Dona Bailey, Atari's first female coin-op programmer, collaborated with *Asteroids* designer Ed Logg to create *Centipede*, a furious bug-blasting arcade game released in 1981. Bailey departed from the video game industry after its huge success, only to reappear 26 years later as a keynote speaker at the 2007 Women in Games Conference. She said that the pressure and criticism she received from her male colleagues forced her out of the industry. Bailey is now a college professor who teaches a variety of game design courses and urges women to pursue employment in the gaming industry (Cohen, 2020).

Rhianna Pratchett is an award-winning scriptwriter and narrative designer. She is best known for her work on titles including *Heavenly Sword*, *Mirror's Edge*, the *Overlord* series, *Tomb Raider* and *Rise of the Tomb Raider*. She has appeared on countless panels, podcasts, and documentaries, and is consistently regarded as one of the most prominent and well-known women of the industry (Ronan, 2018). She has also contributed to various books on games narrative and works with the IGDA Writers' Special Interest Group, the Writers' Guild of Great Britain and BAFTA Games to help improve games narrative and the lot of games writers globally (Leigh, 2017). Her portrayal of in-game females as fun rather than stereotypical has helped to set a precedent for the industry.

Robin Hunicke's game development career began as a game designer for Maxis (Electronic Arts) on the popular *The Sims* franchise. She designed a number of notable games and pushed the gaming industry forward with her scholarly research into "dynamic difficulty adjustment", meaning how a game may adjust the difficulty to suit the skills of individual players, keeping it challenging and fun for all. Hunicke is a supporter of indie game developers and lends her knowledge to worldwide indie game events like the Global Game Jam (Bay, 2020).

2.3 Present

Although video games were once thought to be simple entertainment tools, they now hold a privileged position in the leisure and entertainment market, representing the world's fastest growing industry.

Despite having legal protection as creative works, video games as a form of art have always been a controversial and underappreciated subject to be considered within the leisure and entertainment industry (Wolf, 2001). Art is commonly defined as an activity or a product created with an aesthetic and communicative purpose, in which ideas, emotions, and, more broadly, a worldview are expressed through various resources. Many people associate video games with art solely for the visual aspect, but what makes the medium great is not only what we see, but also what we feel.

Video games are yet another means of expression because subjectivity is an innate characteristic of the human being, which, when viewed as a human limitation, prevents us from creating a neutral cultural product. There is no game that does not convey an idea or a message, which is impossible to avoid and, in fact, should give greater value to the creations as long as professional criteria are followed.

Ideology, whether drawn from any imprint, has a significant influence on us, whether consciously or unconsciously, so that we eventually reflect it in everything that happens to us. As a result, because every value transmitted is part of our daily lives, video games have the potential to influence society.

Video games have become ingrained in society. Not as a passing fad, but as a cultural component. At the beginning of their popularity, gamers were labelled as "weirdos" or "freaks", but according to a recent study published by DFC Intelligence, 40% of the world's total population plays video games in some way (DFC Intelligence, 2020). It is undeniable that playing video games has become a common pastime.

Unfortunately, it has become common practice to blame them for aggressive and inappropriate behaviour by people who have no knowledge of the medium, do not accept it, and frequently regard it as harmful to young people's development. As certain

sectors of society show rejection and mistrust, an increasing number of news sources attribute a teen's crime to a specific video game. Shigeru Miyamoto, the father of modern video games according to many, once said, "They also said that rock music was bad".

It is true that the shooter genre or games with sadistic content are the most commercialised in the industry. They provide the most economic benefits because of its large audience. The violence expressed may incite inappropriate behaviour but an artistic medium such as video games, designed for entertainment, is not guilty of extreme behaviour. Nonetheless, video game developers bear some responsibility. Game design is about determining the best way to convey the intended concept to the player as a whole, so game designers should convey positive values that are opposed to hatred or violence.

Video games have brought families together in front of the television, and online games have connected people separated by millions of kilometres. To play is to go on a journey, to listen to a story, or to create your own. It is something any person can do alone or with a group of friends. This is how video games should be: immersing ourselves in another reality, something that makes us happy, something that terrifies us, something that motivates us, not to escape, but to experience and learn.

According to education experts, teamwork and social skills to collaborate in a common project are fundamental competencies that future generations will need to develop in order to solve social, political, and ecological challenges and problems that exist today. As a result, psychology PhD Xavier Carbonell emphasises that playing online games and interacting with other players can be "a way to prepare for the future job market and academic world".

"We don't want to try to predict the future. We want to make the future. We want to imagine the best scenario and then empower people to make that outcome a reality," says Jane McGonigal, game designer, in her 2010 TED conference, exposing successful projects such as *World Without Oil* (2007), with entirely ethical values.

"Freedom" is the fundamental feature that distinguishes this medium from others such as cinema or literature. A good example would be the graphic adventure genre. It not only allows us to experiment with deeply meaningful choices and different outcomes, but it also expects all of them to be experienced with an ethical and moral foundation. It is a field in which the game, rather than simply acknowledging its ideological capacity, incorporates it into its own gameplay. They pose to the player debates that go beyond the tired notion that video games are unimportant.

3. Conclusions

Time and dedication, both on the part of the gaming community and the developers themselves, will make women achieve equality in the industry and also accept video games as a cultural product and a globally accepted art form. It is uncertain how much it will take until then, but this industry has an unlimited capacity to surprise, as it is constantly evolving and offering new proposals that no one can even imagine right now.

We must remember that the ability to make a good video game, beyond the endless study of a constantly growing industry, is based on effort, affection, and dedication, all of which are unrelated to gender.

Video games have become a mass phenomenon and have the capacity to shape society. People must recognize this and investigate how to make the best possible use of this powerful cultural tool.

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