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Globalization of the Stock Market and the Impact of Artificial Intelligence on Challenging Businesses

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Abstract: *This paper presents and describes the globalization-influenced stock market and business trends. Globalization introduces profound changes and challenges in development conditions. This pattern is manifested in the economic and business spheres. Indeed, Globalization dictates its laws, one of its fundamental characteristics is the internationalization of production, financial markets and the free movement of capital across national borders.*

As a methodology for this study, we reviewed the existing literature, which was the first step in our research and focused on data analysis as well. The results show that since artificial intelligence, businesses and the stock market are phenomena, elements and some of the results of Globalization, we found out that all of them are connected, especially after the appearance and integration of digitalization that facilitates more opportunities between the traders and the stock market.

The conclusions show that in stages of globalization, the growth of artificial intelligence and other forms of automated technology are necessary for the stock market. Artificial intelligence is necessary for business operations and trade opportunities, on the other hand by using it more it becomes more intelligent. All this is important for the Stock market because globalizing the stock market needs artificial intelligence (AI), business opportunities and operations that are challenging from one market to another.

1. INTRODUCTION

Globalization introduces tremendous changes and challenges in the conditions of development. This pattern is manifested in the economic and business fields. Indeed, globalization dictates its laws; one of its fundamental features is the internationalization of production, financial markets, and the free movement of capital across national borders. As a result, capital becomes a cosmopolitan force, flowing from country to country, from region to region, and accumulating where there are better business conditions, higher economic productivity, and opportunities for profit-making.

The regulation of global traders and investors presents a fundamental challenge to law and legal regimes. This is because foreign investment, by its nature, defies and interrogates 'black-box' theories of law which treat nation-states, legal systems, and legal orders as closed systems (Twining et al., 2000).

The arrival of digital work has helped many businesses and companies to advance. 'Siri and Cortana' are extremely useful for those who manage different business projects because they

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become smarter with frequent use as virtual assistants. In addition, having a virtual assistant can be an advantage for companies because, for example, it can help navigate digital change.

Artificial intelligence (AI) can help facilitate team communication between teams, workers, business leaders, entrepreneurs, market makers, and customers, which can help a lot in business.

Every day, new uses of artificial intelligence are discovered, creating models for the data generated by artificial intelligence. That is why it can be considered part of the commercial operations of industries and businesses.

Since the development of computational methods in finance in the 1990s, a great deal of research has focused on applying artificial intelligence to stock market investments. The primary benefits of using computational approaches to automate the financial investment process are the elimination of "momentary irrationality" or decisions based on emotions, the ability to recognize and explore patterns that humans overlook, and the immediate consumption of information in real time. This field of study is called computational finance (Ferreira et al., 2021).

2. LITERATURE REVIEW

2.1. Artificial Intelligence, Business Capabilities and the Global Market

To support our goals, we inspected recent literature to find significant themes that focus on using artificial intelligence in business. We first discussed the models of AI and associated technologies that underlie current technical concerns, as seen in the article by Korinek and Stiglitz. In contrast, (Dagnaw, 2020) emphasizes that companies must be able to resist changes in the intelligence system to benefit from the intelligence revolution. Together, these works suggest how to survive in the market. Companies must adapt to the challenges and take advantage of opportunities.

AI is a technology that attracts the attention of anyone, and the main reason for this affirmation is that it has a tremendous tendency to disturb all aspects of life. Artificial intelligence tends to emit optimism and skepticism with positive and negative aspects collectively (Dagnaw, 2020). Moreover, companies have increasingly turned to AI to generate economic value in recent years. Despite this, enterprises need help incorporating AI into their operations (Enholt et al., 2021). Considering this, technologies are one of the top investment priorities these days (Agata et al., 2020). According to the Gartner report and forecast, more than 740,000 autonomous-ready vehicles will be added to the global market by 2023. In the coming years, software updates could enable higher levels of vehicle autonomy (Gartner, 2019). Advanced autonomous vehicles operating on roads are still not available (Devenport et al., 2018). Artificial intelligence is necessary for companies through business capabilities rather than technologies (Ronanki et al., 2018). Therefore, AI can support three essential things: autonomy of business processes, gaining insight through data analysis, and engaging with customers and employers.

Several definitions of artificial intelligence have been developed to differentiate it from other traditional information technologies. By integrating two concepts, intelligence refers to mental activity with artificial which infers that humans create something instead of by nature; Artificial intelligence can be defined as the capacity of machines to simulate intelligence (Enholt et al. 2021). Harkut and Kasat (2019) call into question how artificial intelligence is proceeding, and he emphasizes that any task performed by a computer program or machine usually requires

human intelligence. AI is the simulation of human intelligence processes by computers and other technologies. It is a branch of research and a collection of computing approaches inspired by how the human nervous system and the body are used to feel, learn, reason and act.

However, artificial intelligence has directly or indirectly affected our lifestyle and is shaping tomorrow's future. AI has already become an integral part of our daily lives and has had a significant impact on our way of life, despite the ubiquity of digital assistants on mobile phones, driver assistance systems, bots, text and speech translators, and systems that aid in recommending products and services and in customized learning (Harkut & Kasat, 2019).

Artificial intelligence could be relevant and less expensive to society through its application in financial and professional services (Devenport et al., 2018, p. 116). Exploring cognitive technologies should be necessary for companies, and there is no space for complacency in the workforce and ethics of intelligent machines. However, cognitive technology could lead to a golden age of productivity, satisfaction, and prosperity with proper planning and development (Devenport et al., 2018).

2.2. Artificial Intelligence, Businesses, Market Integration and the Stock Market

Artificial intelligence impacts and transforms businesses by increasing human work (Daugherty et al., 2018). Focus is on using AI to achieve more flexibility, better decision-making, grander scale, and productivity (Wilson & Daugherty, 2018). Companies should think about and reimagine their business processes (Wilson & Daugherty, 2018). When humans and machines work together, firms achieve the most significant process and performance improvements, which is why many companies have used artificial intelligence to automate the process (Wilson & Daugherty, 2018). Companies should understand how humans may augment machines in such a practical way since machines can boost what humans do best (Wilson & Daugherty, 2018). Machines and humans can work together in a relationship of augmentation rather than automation (Davenport & Bean, 2017). In creative problem-solving, intelligent machines will be partners and collaborators (Davenport & Kirby, 2015).

The analysis of financial market integration bases on different approaches. One deal with the sensitivity of international capital flows of interest-rate differentials and the other approach focuses on the degree of integration between markets as evidenced by interest rates (Bhoocha-oom & Stansell, 1990).

Market integration can be measured in 3 ways. First, by using the interest rate parity approach that examines the degree to which interest rate differentials on assets of comparable risk are related to the forward premium or discount on one of both currencies involved. The second way is by applying the convergence of interest rates approach that examines the level of interest rates among countries. The third way is by using the co-variability of interest approach that analyzes changes in rates (Bhoocha-oom & Stansell, 1990).

If co-variability exists that shows that the prices of financial assets in countries move in conjunction (Bhoocha-oom & Stansell, 1990). Because of different levels of risk, different rate levels may exist (Bhoocha-oom & Stansell, 1990).

3. OPPORTUNITIES AND CHALLENGES FOR BUSINESSES THAT ARE USING/IMPLEMENTING AI TECHNOLOGY

Today, for each business, it is essential to understand the challenges and obstacles that could impact them by implementing or adopting artificial intelligence technology. Moreover, it is necessary to realize that in addition to the positive aspects, the negative ones keep them stepping back and reanalyzing its usage and role.

The first opportunity AI brings to a business is improved economic outcomes and productivity, similar to previous technological developments. More precisely, AI will increase the rate and effectiveness of manufacturing. However, the research also notes that precisely quantifying AI's influence will be challenging and that there currently needs to be an appropriate means for doing so. The second opportunity is for businesses to enhance or aid human decision-making. AI helps users integrate and uncover hidden patterns or anomalies among vast and diverse datasets. As a result, policymakers can employ AI systems to generate data-driven policies, even though such systems' validation and potential programmed bias still need to be fully known. The third opportunity for businesses is to improve problem-solving: the current state of AI research offers an expansion of the technology's applications to societal difficulties while reducing the regulatory oversight costs on the government and those regulated (Dagnaw, 2020). Finding some opportunities, (Dagnaw, 2020) also shows that we need to extend our view, focus on the challenges, and extend our conceptual understanding of the provocations that might come with implementing AI technology within a company.

The first challenge that might come into view is data collection and sharing obstacles. Artificial intelligence systems that use disparate data sources may encounter difficulties accessing and integrating data from sources whose regulatory accessibility, completeness, and general quality differ. The second challenge that might be materialized is the limited access to computing resources and human capital: Developers, researchers, and implementers in various government organizations or agencies may need help acquiring and financing the computing power and talent-intensive requirements of AI systems. The third challenge is the legal and regulatory obstacles: The fast development and use of AI systems have overtaken the legislative framework that governs how and when these systems should be used effectively and safely for their diverse applications. The government will require new technical knowledge to ensure that AI policy is current and appropriate for the technology. The fourth challenge might enter the picture when developing ethical, explicable, and acceptable AI applications. As AI systems improve and surpass human capabilities, it will be crucial that the actions and decisions derived from these systems can be held to the same standards of accountability as the human decision-makers they are assisting and replacing (Dagnaw, 2020).

Furthermore, Harkut and Kasat (2019) raise a similar point highlighted by Dagnaw (2020), signaling that there are ten challenges that a business can face while implementing artificial intelligence technology. Building trust is one of the issues because AI is all about science, technology, and algorithms that people usually need to be made aware of, making it difficult for them to trust. Another challenge comes with the development of artificial intelligence that accelerates. There need to be more qualified professionals who can meet demand and utilize this technology. Therefore, business owners must teach their professionals to use the benefits of this technology. In addition to technological development, AI is a costly technology for which only some business owners or management can spend money. Moreover, software malfunction is another

challenge, meaning that automation makes it difficult to pinpoint the origin of mistakes and problems.

Regarding the responsibilities and replacement of tasks, AI has its limitations, just like any other technology, and cannot replace all charges. However, this will result in new employment domains with different job profiles. In addition, many technologists and scientists with different goals, motivations, and interests research artificial intelligence. Research focuses on unraveling the mysteries of human intelligence and cognition, and in this scenario, AI may be misunderstood and have high expectations.

Machine learning and artificial intelligence applications depend on massive amounts of classified data, often sensitive and personal. As a result, data leaks and identity theft are serious vulnerabilities. In addition, enterprises and governments seeking profit and power use AI-based tools that are often internationally networked and impossible to manage. One of the last challenges is data-driven AI considering that its accuracy depends on training and data. Training data with racial, gender, communal, or ethnic biases will lead to unethical and unfair decisions. The tendencies will undoubtedly increase as AI systems are taught with erroneous data.

The last challenge refers to the power and capacities of AI, and AI applications are directly dependent on the quality and relevance of supervised and labeled training and learning datasets. Therefore, there needs to be more data with quality labels. Transfer learning, active learning, deep learning, and unsupervised learning are now being utilized to develop techniques that will allow AI models to learn despite the lack of high-quality labeled data, which will exacerbate the problem (Harkut & Kasat, 2019).

4. ARTIFICIAL INTELLIGENCE IN STOCK MARKET INVESTMENT

Stock trading is an investment in which investors purchase and sell firm shares on the stock exchange. The market is extremely volatile and highly dependent on economic events. Therefore, significant trading experience and awareness of the latest financial news are needed for profitable trading. In artificial intelligence analysis, providing results every millisecond is beneficial. As a result, AI has begun to play a magical role in trading. It includes reliable and timely information by predicting stock prices using historical data. Essentially, it combines the trading community, and by scanning all trades, it performs better.

Although many businesses employ AI to help the economy, Amazon proposes products to customers. Netflix creates materials based on artificial intelligence, generating substantial demand in the current market. Companies are implementing artificial intelligence in several industries, including travel/tourism, education, and health care. Primarily in retail and media, entertainment has moderate AI usage. For automation and financial services, AI is heavily utilized (Gonzales & Hargreaves, 2022).

In financial portfolio management, artificial intelligence tools can help increase performance. AI's capabilities make it vital for trading today. With financial services, AI aids in model validation, backtesting, trading, and portfolio composition, as well as fraud detection (Mohapatra et al., 2021).

5. COMPANIES, TRADERS AND THE STOCK MARKET

A company has a total number of shares, which are divided into principal shares for investors with a vote in the meetings and public shares for stock market listing, the value of these public shares is the price at which they are willing to buy and sell to investors. If a company promises growth, people will pay more to get rid of their shares and the opposite is if it looks weak people will sell their shares at a lower price in order to get rid of them.

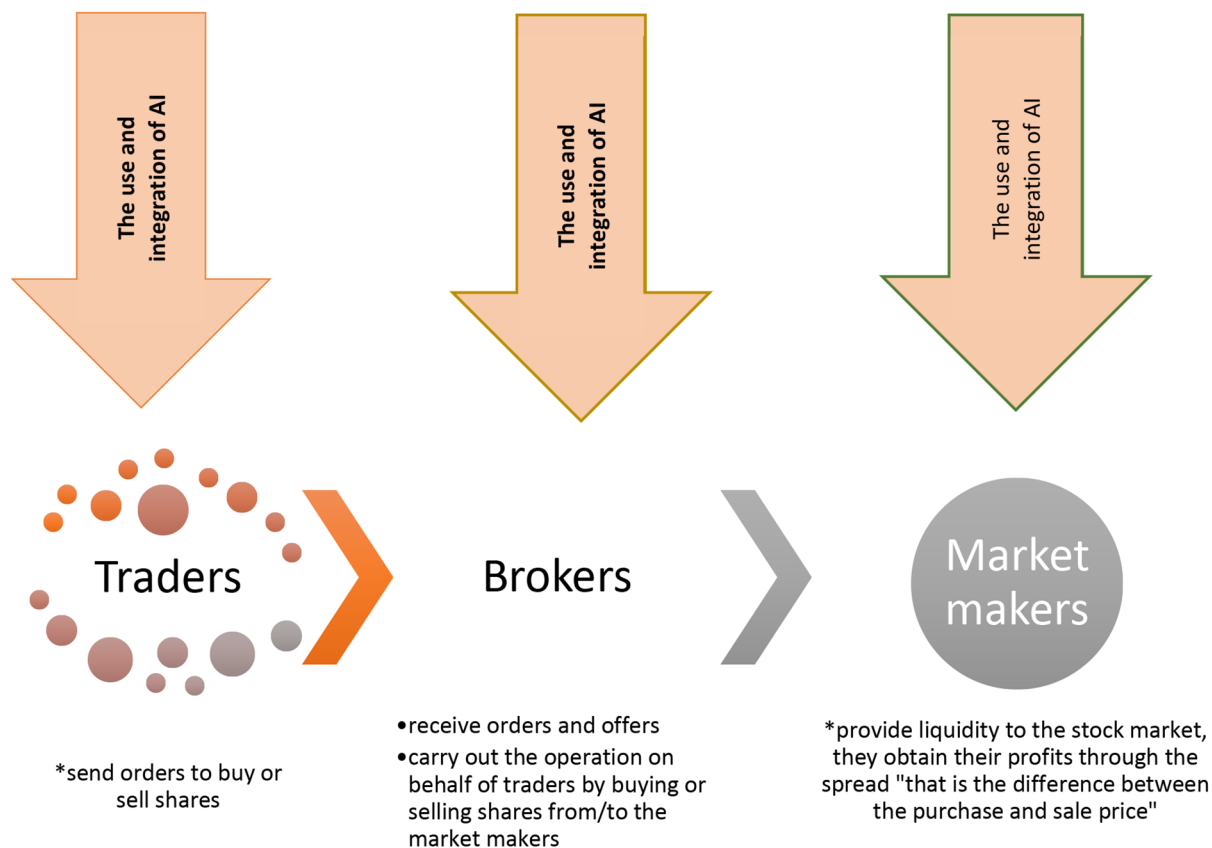


Figure 1. The application and integration of Artificial intelligence in the stock market and its main elements

Source: Authors' design, 2022

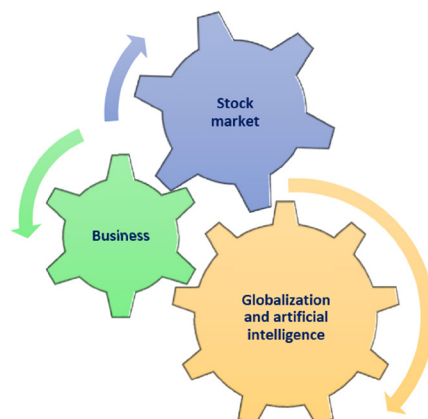


Figure 2. Illustration of the connection between Globalization, business, artificial intelligence and the stock market

Source: Authors' design, 2022

A trader sends his orders through the brokers' platforms and they carry out the operation with the market makers, but the brokers are also companies that carry out operations to buy and sell shares on behalf of the traders, they are the ones that offer their platforms to that traders can connect and operate in the market (Figure 1).

The stock market greatly needs the support of market makers, which are institutions that have a large inventory of shares from different companies available to be sold to investors immediately (Figure 1). This gives the stock market great liquidity and they are always prepared to offer a price of purchase and another of sale for the trader so that he can execute his operations at any time; these market makers obtain their profits through the spread which is the difference between the purchase price and the sale price that they offer for the shares, for example, the purchase and sale of the dollar where the exchange houses earn this difference or spread.

6. RESULTS

The results show some interesting publications, but more was needed to cover the connection between globalization and its influence on the stock markets and AI from a business point of view. In addition, the price movement of all markets is sometimes more predictable. Thus, globalization has dramatically impacted challenging businesses. Through this research paper, we have reviewed the relevant literature to conduct a rigorous inquiry, corroborating the proposed scientific approach from a theoretical standpoint with data analysis.

Moreover, the results of our study and analysis show that since there are many markets, some markets can be less efficient because investments have variable random prices that cannot be predicted.

7. CONCLUSION

Therefore, Globalization has a huge impact on the stock market, financial integration, negotiations, business challenges, and technology that requires and relies more on digitalization and security by using and developing artificial intelligence for more operations and integrations in the Stock market. Businesses should start investing and making money in the stock market. AI is becoming increasingly intelligent. When AI combines large amounts of data, an enormous analytical capability is possible. Many AI approaches still need to be evaluated in a financial crisis. More trainers are required to educate individuals to do the jobs and ensure a business's success.

Since artificial intelligence, businesses and the stock market are phenomena, elements and some of the results of Globalization, we found out that all of them are connected, especially after the appearance and integration of digitalization (Figure 2).

Artificial intelligence is necessary for business operations and trade opportunities because the more you use it, the more intelligent it becomes. All this is important for the Stock market as was pointed out (Figure 1) because globalizing the stock market needs both Artificial intelligence and business opportunities and operations that are challenging from one market to another.

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A Multiple Fluctuations and Detrending Analysis of Financial Market Efficiency: Comparison of Central and Eastern European Stock Indexes

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Abstract: *The analysis of stock market behaviour is still a very appealing topic because it can give investors information about where to invest their money. In this context, a dynamic investigation of Austria's (ATX), Serbia's (BELEX 15), Hungary's (BUX), Croatia's (CROBEX), Russia's (IMOEX), Czech Republic's (PX PRAGUE), Slovenia's (SBITOP), and Poland's (WIG) capital markets is carried out from September 18th, 2017, to September 15th, 2022. The results suggest that most indexes are far from being absent of long-term dependency, which may be interpreted as inefficiency; that is, throughout the Tranquil period, the stock market indexes SBI TOP (0.59), AEX (0.54), WIG (0.54), PRAGUE (0.53), and BELEX 15 (0.52) exhibit dependence over time. The CROBEX (0.47) and BUX (0.44) indexes indicate anti persistence, however, the Russian market shows equilibrium (0.49 ± 0.0126), indicating that the random walk hypothesis is not rejected. When we look at the behaviour of the markets under consideration during the Stress subperiod, we see that persistence was significantly higher in the capital markets under analysis, except for the Russian market, which demonstrates some equilibrium. To conclude, we suggest that policymakers must take a comprehensive approach to improve the efficiency of international financial markets during times of stress due to uncertainty in the global economy and its influence on the memory properties of capital markets.*

1. INTRODUCTION

The evolution of capital markets is changing in the wake of recent financial crises; the dynamism of capital markets causes the need for research on predictability in capital markets (i.e., we can anticipate future prices based on a series of previous prices). Investors usually fail to make a substantial profit, but anomalies in stock prices that deviate from their intrinsic value are detected (Bagão et al., 2020; Dias & Santos, 2020a, 2020b; Silva et al., 2020).

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According to the literature, a financial market is efficient when the competition among its various participants is equal, followed by the principle of maximum benefit, which leads to an equilibrium situation in which market prices of any security are a good estimate of the theoretical or intrinsic price (Dias, Pardal et al., 2021; Dias, Heliodoro, Alexandre, Santos & Vasco, 2021; Dias & Carvalho, 2021; Santos et al., 2021; Vasco et al., 2021).

One of the fundamental concepts of financial theory is market efficiency, in which financial asset prices provide appropriate signals for the acquisition of resources. The market efficiency hypothesis assumes that an investor cannot acquire an exceptional risk-adjusted return. However, several empirical investigations have demonstrated that an investor may achieve a higher return than the market average (Dias, Pardal, et al., 2022; Guedes et al., 2022; Horta et al., 2022; Sun et al., 2022).

Given the events of 2020, the oil price war between Russia and Saudi Arabia, and the Russian invasion of Ukraine in 2022, it is necessary to assess the presence of long memories in the capital markets of Austria (ATX), Serbia (BELEX 15), Hungary (BUX), Croatia (CROBEX), Russia (IMOEX), Czech Republic (PX PRAGUE), Slovenia (SBITOP), and Poland (WIG) from September 18th, 2017, to September 15th, 2022. The findings indicate that global economic uncertainty has had an impact on the memory properties of the capital markets studied; this evidence suggests that returns are autocorrelated over time, indicating some predictability in price formation.

This research has two major additions to the literature. Given the importance of these regional markets in the global competitive context, as well as the need for more empirical studies, particularly confirmatory on the financial dynamics in these markets, it was deemed extremely relevant to study the Central and Eastern European stock markets, with the Russian invasion of Ukraine in 2022 in mind. The second contribution is of an economic and econophysical nature, with results comparing econometric methodologies, econophysical models, and mathematical models capable of evaluating correlations in a non-stationary context.

This article is divided into five sections in terms of structure. Section 2 is a review of the literature on predictability in international capital markets. The methods and data are described in Section 3. The results are presented in Section 4. The fifth section concludes.

2. LITERATURE REVIEW

Several pieces of research have been conducted to investigate the implications of the Efficient Market Hypothesis (EMH), which argues that the present price of assets reflects all available information at a particular moment and that the price changes swiftly as new and unexpected information enters the market (Fama & French, 1988).

Smith and Ryoo (2003) tested predictability in European emerging markets, namely the indexes of Greece, Hungary, Poland, Portugal, and Turkey, and suggested that, except for Turkey, markets' returns are predictable (Istanbul). Borges (2010), on the other hand, examined the occurrence of long memories in the capital markets of the United Kingdom, France, Germany, Spain, Greece, and Portugal during the period from January 1993 to December 2007. The author demonstrates that daily and weekly returns are not normally distributed since they are skewed and leptokurtic, and they also display conditional heteroscedasticity. Overall, the

random walk hypothesis is refuted in daily data for Portugal and Greece, whereas weekly data for France and the United Kingdom demonstrate long memories. In Germany and Spain, the random walk hypothesis is not rejected.

Later, authors Santos et al. (2020) examined persistence in Argentina, Brazil, Chile, Colombia, Peru, and Mexico's capital markets from January 2018 to July 2020, demonstrating that stock index returns have a non-linear nature or a significant non-linear characteristic, except for Argentina's capital market. In a complementary way, the authors show that the DFA exponents show long-range memories, namely the Colombian (0.72), Chilean (0.66), Brazilian (0.58) and Peruvian (0.57) markets. The Argentinean market does not reject the random walk hypothesis, while the Mexican market shows some anti-persistence (0.41). Meanwhile, Dias and Santos (2020a) examined efficiency in its weak form in the capital markets of Botswana, Egypt, Kenya, Morocco, Nigeria, and South Africa from September 2nd, 2019, to September 2nd, 2020. The authors emphasize that the variance ratios are less than one, implying that the returns are autocorrelated over time and that there is a reversion to the mean, with no differences seen between the markets studied.

Dias, Heliodoro, Alexandre, Santos, and Farinha (2021) investigated the predictability of Eastern European capital markets, discovering that daily returns do not have normal distributions, have negative asymmetries, are leptokurtic, and show conditional heteroscedasticity. During the 2020 worldwide pandemic period, the DFA exponents vary from 0.64 to 0.75, indicating significant long memories in all markets except for Slovakia's capital market (0.45). Additionally, Vasco et al. (2021) examined predictability in the capital markets of Brazil, China, South Korea, USA, Spain, and Italy from December 2nd, 2020, to May 12th, 2020. The authors demonstrate that the 2020 worldwide pandemic has a considerable influence on the efficiency of these markets, implying that the stock markets studied are somewhat predictable.

In more recent studies, Dias, Pardal, et al. (2022) examined the presence of long memories in nine capital markets in Europe from June 5th, 2017, to June 3rd 2022, and found that the 2020 global pandemic and the Russian invasion of Ukraine made the markets predictable, implying that the random walk hypothesis is significantly rejected. Guedes et al. (2022), on the other hand, assess whether the recent 20 years' financial crises have affected efficiency in G20 capital markets from January, 2nd, 2000, to February 5th, 2021. The authors demonstrate that markets exhibit symptoms of (in) efficiency in each sliding window (1000 days), namely asymmetries, non-Gaussian distributions, and DFA exponents higher than 0.5. In addition, Zebende et al. (2022) used intraday data to measure market efficiency in G20 capital markets, implying and taking into account the DFA method that markets tend to be efficient for maturities of less than 5 days, while stock markets tend to be inefficient for maturities greater than 10 days. Dias, Pereira et al. (2022), on the other hand, tested the efficient market hypothesis, in its weak form, in the capital markets of Botswana, Egypt, Kenya, Morocco, Nigeria, South Africa, Japan, the United Kingdom, and the United States from September 2nd, 2019, to September 2nd, 2020. The authors show that returns are autocorrelated over time, implying that the random walk hypothesis is rejected in all markets studied, with no differences between mature and emerging economies.

In summary, the goal of this study is to aid investors and regulators in European capital markets where individual and institutional investors seek diversification advantages, as well as to support the implementation of policies that contribute to the efficiency of international capital markets.

3. DATA

The data analysed are the capital market pricing indexes of Austria (ATX), Serbia (BELEX 15), Hungary (BUX), Croatia (CROBEX), Russia (IMOEX), Czech Republic (PX PRAGUE), Slovenia (SBITOP), and Poland (WIG) from September 18th, 2017, to September 15th, 2022. The sample was divided into two sub-periods: the Tranquil period, which spans the years September 18th, 2017, to December 30th, 2019, while the Stress period, which extends from January 2nd, 2020, to September 15th, 2022. The quotations are obtained daily using the DataStream platform and are in local currency to mitigate exchange rate distortions.

Table 1. The name of countries and their indexes used in this paper

Country	Index
Austria	ATX
Serbia	BELEX 15
Hungary	BUX
Croatia	CROBEX
Russia	IMOEX
Czech Republic	PX PRAGUE
Slovenia	SBITOP
Poland	WIG

Source: Own elaboration

4. METHODOLOGY

The investigation will proceed in stages. In the first step, we will create graphs in levels to better comprehend market fluctuations and potential structural breaks. In a subsequent stage, we will characterize the sample using descriptive statistics to determine if the data has a normal distribution. To determine if the time series represent white noise (mean = 0; constant variance), we will employ the panel stationarity summary test, which combines the tests of [Levin et al. \(2002\)](#); [Im et al. \(2003\)](#) and [Dickey and Fuller \(1981\)](#); [Phillips and Perron \(1988\)](#) with Fisher transformation. To validate residual stability, we will use the CUSUM square test; to understand when the most significant structural break occurs, we will use the test of [Clemente et al. \(1998\)](#). To solve the study issue, we will use the econophysical technique of Detrended Fluctuation Analysis (DFA). DFA is a method for analysing time dependency in nonstationary time series. By assuming that time series are nonstationary, this method prevents spurious results when the study focuses on the long-run relationships of time series. [Peng et al. \(1994\)](#) developed this methodology, which has its roots in the study of DNA behaviour. This approach was then used to investigate the behaviour of financial series. The DFA interprets it as follows: $0 < \alpha < 0.5$: anti persistent series; $\alpha = 0.5$ series presents random walk; $0.5 < \alpha < 1$ persistent series.

5. RESULTS

Figure 1 depicts the evolution, in levels, of the capital markets of Austria (ATX), Serbia (BELEX 15), Hungary (BUX), Croatia (CROBEX), Russia (IMOEX), Czech Republic (PX PRAGUE), Slovenia (SBITOP), and Poland (WIG) from September 18th, 2017, to September 15th, 2022. The graphs show the instability caused by the 2020 global pandemic, but also by the start of Russia's invasion of Ukraine, which altered the international socioeconomic, financial, and political scene, resulting in the emergence of a scenario marked by enormous unpredictability and uncertainty, as reflected in the expressive correction movements in the major world stock market

indexes and the activation of volatility. Dias, Pardal, et al. (2022); Teixeira, Dias, Pardal, and Horta (2022) support these findings by demonstrating significant structural breaks triggered by the 2020 and 2022 events.

Table 2 shows the descriptive statistics, return, of the capital markets of Austria (ATX), Serbia (BELEX 15), Hungary (BUX), Croatia (CROBEX), Russia (IMOEX), Czech Republic (PX PRAGUE), Slovenia (SBITOP), and Poland (WIG) from September 18th, 2017, to September 15th, 2022. According to the findings, the WIG and ATX indexes are the only ones with negative average returns. Among the stock market indexes analysed, the SBI TOP has the highest average daily return (0.000291). In turn, the Russian index (IMOEX) has the highest standard deviation (0.018450), while the BELEX 15 has the lowest (0.006947). To determine if the time series follow a normal distribution, we examine the asymmetry of the data and check for negative and non-zero asymmetries; also, we check that the kurtosis have values other than 3, indicating non-Gaussian distributions. In addition, we estimated the Jarque and Bera (1980) test, which confirms the rejection of the data's normality hypothesis, exhibiting that the time series do not have normal distributions.

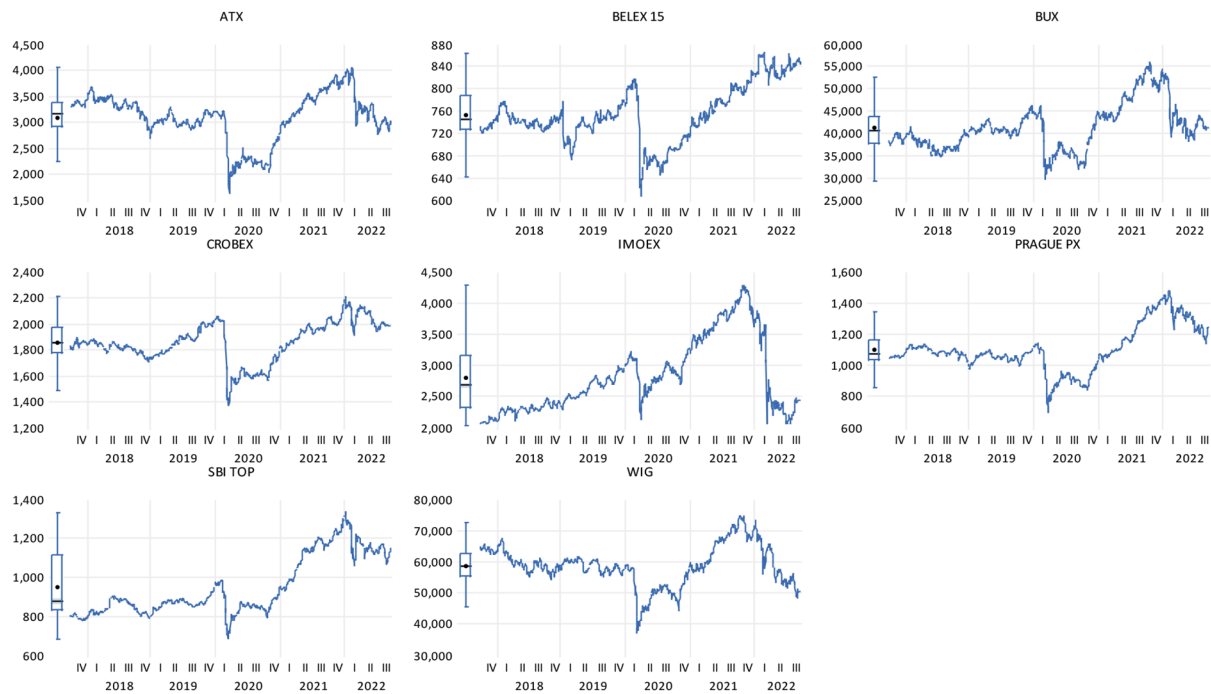


Figure 2. Evolution, in levels, of the European capital market fluctuation for the period from September 18th, 2017, to September 15th, 2022

Source: Own elaboration

Table 2. Summary descriptive statistics, in returns, of Europe's capital markets for the period from September 18th, 2017, to September 15th, 2022

	ATX	BELEX 15	BUX	CROBEX	IMOEX	PRAGUE	SBI TOP	WIG
Mean	-8.49E-05	0.000117	5.49E-05	7.80E-05	0.000137	0.000137	0.000291	-0.000195
Std. Dev.	0.014819	0.006947	0.014134	0.008240	0.018450	0.010112	0.009027	0.013147
Skewness	-1.231871	-1.068310	-1.477502	-3.907048	-8.081235	-1.194789	-1.980833	-1.403024
Kurtosis	18.69780	15.33660	15.46578	53.60873	196.4023	15.81751	23.65061	18.53894
Jarque-Bera	13224.21	8210.143	8596.194	137343.2	1972739.	8903.676	23157.21	13058.80
Probability	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000
Observations	1257	1257	1257	1257	1257	1257	1257	1257

Source: Own elaboration

Table 3 presents the panel stationarity summary test, which contains the tests of [Levin et al. \(2002\)](#), and [Im et al. \(2003\)](#), as well as the tests of [Dickey and Fuller \(1981\)](#), [Phillips and Perron \(1988\)](#) with Fisher transformation. The applied tests presume the existence of unit roots in the observable components of the time series as the null hypothesis. When the results of the LLC test are compared, we can see that stationarity is reached in the first differences with a significance of 1%.

Table 3. Summary panel stationarity tests
for the period from September 18th, 2017, to September 15th, 2022

Group unit root test: Summary				
Method	Statistic	Prob.**	Cross sections	Obs
Null: Unit root (assumes common unit root process)				
Levin, Lin & Chu t^*	-102.439	0.0000	8	10034
Null: Unit root (assumes individual unit root process)				
Im, Pesaran and Shin W-stat	-85.9182	0.0000	8	10034
ADF - Fisher Chi-square	1179.10	0.0000	8	10034
PP - Fisher Chi-square	795.875	0.0000	8	10040

Note: ** Probabilities for Fisher tests are computed using an asymptotic Chi-square distribution. All other tests assume asymptotic normality.

Source: Own elaboration

Figure 2 depicts the CUSUM square test, which was applied to time series from the capital markets of Austria (ATX), Serbia (BELEX 15), Hungary (BUX), Croatia (CROBEX), Russia (IMOEX), Czech Republic (PX PRAGUE), Slovenia (SBITOP), and Poland (WIG) from September 18th, 2017, to September 15th, 2022. The CUSUM square model is a diagnostic test for detecting structural changes in time series residuals. Because the red line corresponds to the cumulative total, the null hypothesis (stability) is not rejected at a 5% significance level if the blue line remains within the confidence interval. Because all of the tests had statistics that fall beyond the critical bands of the 95 percent confidence interval, the results suggest the presence of instability.

Through the test of Clemente et al. (1998), we can validate the most substantial break in the structure of the time series in Figure 3. All of the indexes under consideration have significant structural breaks; the SBI TOP and CROBEX indexes break in 2017, while the ATX and BELEX 15 markets break in March 2020, coinciding with the 2020 pandemic. The BUX, IMOEX, PRAGUE, and WIG markets all had significant structural breaks in the first quarter of 2022, most likely as a result of their closeness to Russia. These findings are consistent with [Dias and Santos \(2020a\)](#), [Dias and Carvalho \(2021\)](#), [Dias, Pereira, et al. \(2022\)](#), [Teixeira, Dias, Pardal, and Horta \(2022\)](#), [Dias, Pardal, et al. \(2022\)](#), [Horta et al. \(2022\)](#), which reveal significant breaks in structure due to events in 2020 and 2022.

In order to investigate the price movement of the stock market indexes of Austria (ATX), Serbia (BELEX 15), Hungary (BUX), Croatia (CROBEX), Russia (IMOEX), Czech Republic (PX PRAGUE), Slovenia (SBITOP), and Poland (WIG) from September 18th, 2017 to September 15th, 2022, the DFA exponents were estimated for two sub-periods, Tranquil and Stress, with the first characterized by relative stability in international financial markets while the second by significant market complexity due to events such as the Covid-19 pandemic crisis and Russia's invasion of Ukraine in 2022.

We can see the DFA exponents of the stock market indexes SBI TOP (0.59), AEX (0.54), WIG (0.54), PRAGUE (0.53), and BELEX 15 (0.52) throughout the Tranquil period, and we can verify

values more than 0.5. The CROBEX (0.47) and BUX (0.44) indexes exhibit anti-persistence, however, the Russian market exhibits equilibrium ($0.49 \cong 0.0126$), indicating that the random walk hypothesis is not rejected.

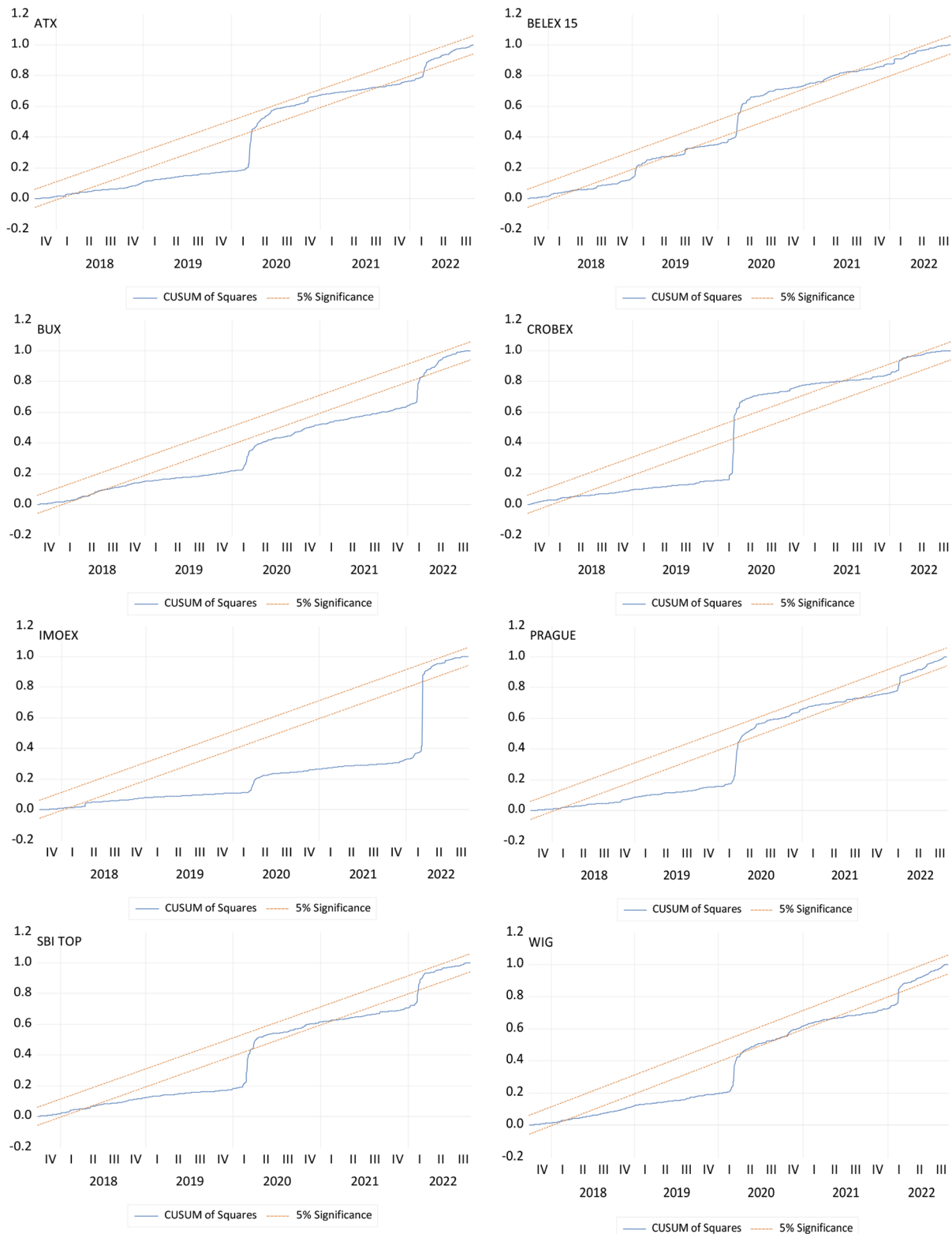
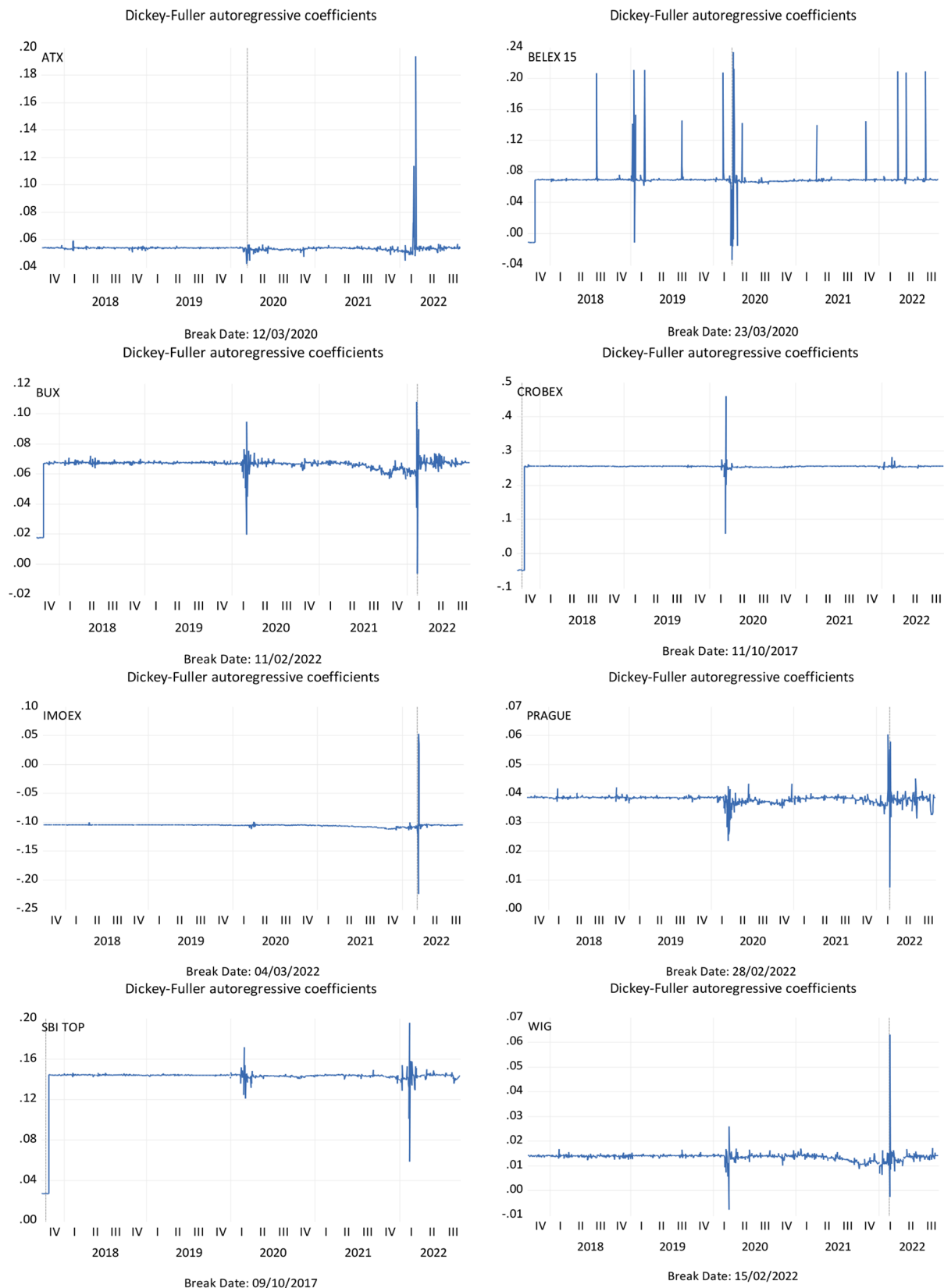


Figure 3. CUSUMSQ test applied to European capital markets for the period from September 18th, 2017, to September 15th, 2022

Source: Own elaboration



Note: Data worked by the author (software: Eviews12)

Figure 4. Clemente et al. (1998) stationarity test postulating structure breaks, over the period September 18th, 2017, to September 15th, 2022

Source: Own elaboration

During the Stress period, we can see that persistence increased. As we can see, the indexes CROBEX (0.69), SBI TOP (0.65), PRAGUE (0.64), BELEX 15 (0.64), AEX (0.62), WIG (0.60), BUX (0.59) all have significant exponents above 0.5, with the exception of the Russian capital market (IMOEX (0.49 \cong 0.0208), which shows signs of equilibrium during a period of uncertainty. These findings are consistent with the findings of the authors Guedes et al. (2022), Teixeira, Dias, Pardal and Styles (2022), Dias, Pardal, et al. (2022), Horta et al. (2022), Zebende et al. (2022), Dias, Pereira, et al. (2022), who demonstrate the existence of long memories during stressful periods in international financial markets.

Table 4. DFA exponent for index and return (the values of the linear adjustments for α DFA always had $R^2 > 0.99$)

Stock market	DFA exponent (Tranquil)	DFA exponent (Stress)
AEX	0.54 \cong 0.0012***	0.62 \cong 0.0014***
BELEX 15	0.52 \cong 0.0025***	0.64 \cong 0.0018***
BUX	0.44 \cong 0.0136***	0.59 \cong 0.0017***
CROBEX	0.47 \cong 0.0017***	0.69 \cong 0.0427***
IMOEX	0.49 \cong 0.0126	0.49 \cong 0.0208
PRAGUE	0.53 \cong 0.0098***	0.64 \cong 0.0014***
SBI TOP	0.59 \cong 0.0096***	0.65 \cong 0.0095***
WIG	0.54 \cong 0.0038***	0.60 \cong 0.0011***

Note: The hypotheses are H0: $\alpha = 0.5$ and H1: $\alpha \neq 0.5$. ***, **, *, that represent significance at 1%, 5% and 10%, respectively.

Source: Own elaboration

6. CONCLUSION

The general conclusion to be retained and sustained by the results obtained employing econometric and econophysical models is that the global pandemic of 2020 and the Russian invasion of Ukraine in 2022 impacted the memory properties of Austria (ATX), Serbia (BELEX 15), Hungary (BUX), Croatia (CROBEX), Russia (IMOEX), Czech Republic (PX PRAGUE), Slovenia (SBITOP), and Poland's capital markets (WIG). This has implications for investors because certain returns may be expected, which opens up the potential for arbitrage and extraordinary returns. These findings also suggest that market regulators should take initiatives to improve information disclosure in these regional markets.

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Efficiency and Long-Term Correlation in Central and Eastern European Stock Indexes: An Approach in the Context of Extreme Events in 2020 and 2022

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Abstract: *The analysis of the behaviour of capital markets remains a very interesting issue as it can give investors information about where to invest their money. Given the importance of measuring autocorrelation in financial markets, this paper aims to analyse the predictability of capital markets, namely Austria (Austrian Traded), Budapest (BUX), Bulgaria (SE SOFIX), Croatia (CROBEX), Russia (MOEX), Czech Republic (PragueSE PX), Romania (BET), Slovakia (SAX 16), and Slovenia (SBI TOP), for the period from January 1st, 2020, to May 6th, 2022. To conduct this analysis and obtain more robust results we partitioned the sample into three sub-periods: 1st wave of Covid (January 2020 to December 2020), 2nd wave of Covid (January 2021 to December 2021), and the Russian invasion of Ukraine in 2022 (January 2022 to May 2022). The results of the Lagrange Multiplier test (ARCH-LM test), show that the residuals of the autoregressive processes of the capital markets under analysis exhibit conditional heteroscedasticity. Furthermore, the BDS test findings indicate the presence of non-linear components, implying that the hypothesis that the returns are independent and identically distributed is rejected, with a statistical significance of 1%, from dimension 2 onwards. Overall, the DFA exponents show that the Russian invasion of Ukraine in 2022 had a different impact on the predictability of these regional markets indicating that markets were predictable and showed pronounced long memories during the first wave of Covid-19, while markets mostly tended towards equilibrium during the last sub-period of 2022. The authors believe that this research is crucial for policymakers and investors in Central and Eastern Europe capital markets in terms of regional development initiatives and portfolio diversification strategies.*

1. INTRODUCTION

The Efficient Market Hypothesis (EMH) remains the dominant paradigm for analysing asset price behaviour, implying that prices should behave randomly and that the order of integration of logarithmic price series should be one. The theory states that trading at a profit based on previous prices should be impossible, and it has been tested in various empirical investigations analysing the (fractional) order of integration of the price series, as well as its persistence and reversion to the mean (Fama, 1965a, 1965b, 1970, 1991; Fama & French, 1988).

Several studies have been conducted to examine the consequences of the EMH, which states that the present price of assets reflects all available information at a particular moment and the price changes swiftly as new and unexpected information enters the market (Fama & French, 1988).

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The development of capital markets is changing in the wake of recent financial crises; the dynamism of capital markets causes the need for research on predictability in capital markets (that is, we can anticipate future prices based on a series of previous prices). Investors often fail to make an excessive profit, however, anomalies are observed in stock prices that deviate from their intrinsic value (Degutis & Novickytė, 2014).

The tremendous growth of emerging and developing markets brings new approaches to scientific research. The efficiency of stock markets is one such topic. Several studies have been conducted in the last two decades considering the EMH, focusing on developed markets and some developing countries. However, there is a lack of literature on Central and Eastern European nations, particularly during the 2020 and 2022 events. Following the 2008 global financial crisis, there has been a great rise in interest in emerging and developing markets, with many asking whether these markets can withstand capital inflows without breaking. Given these developments and the potential gap in the literature, the purpose of this paper is to examine the predictability of capital market return in Austria (Austrian Traded), Budapest (BUX), Bulgaria (SE SOFIX), Croatia (CROBEX), Russia (MOEX), Czech Republic (Prague SE PX), Romania (BET), Slovakia (SAX 16), and Slovenia (SBI TOP), for the period from January 1st, 2020, to May 6th, 2022. The authors demonstrate that during the first wave of Covid-19, markets were predictable and exhibited pronounced long memories, however in the last sub-period of 2022, markets tended to converge towards equilibrium.

In terms of structure, this paper is organized into 5 sections. Section 1 is represented by the current introduction. Section 2 presents a Literature Review of articles on the random walk hypothesis in capital markets. Section 3 describes the data and the methodology. Section 4 contains the results. Finally, Section 5 presents the general conclusions of the paper.

2. LITERATURE REVIEW

The importance of studying the level of autocorrelation and predictability of financial markets is due to the existence of volatility clusters; this phenomenon has been advocated by several authors, including, Brock and De Lima (1996), Schwert (1997), Ramlall (2010), Chong (2011), and Angabini and Wasiuzzaman (2011), among others, who identified the existence of volatility clusters in stock markets. This phenomenon is related to different volatility scales exhibiting autocorrelation, causing high (low) volatility events to tend towards clustering over time, i.e., autocorrelation and persistence brings the EMH into doubt. These prediction phenomena can lead to significant levels of arbitrage, suggesting that investors with adjusted trading strategies could achieve abnormal returns without incurring additional risk.

The authors, Schwert (1997), Los and Lipka (2005), and Kasman et al. (2009), evaluated persistence in European capital markets. Schwert (1997) examined the EMH in the Czech Republic capital market; for this purpose, he analysed the linear dependencies to avoid any misinterpretations, in the period 1995-2005. The author demonstrates that capital markets as in the United States, Germany, and the Netherlands, are less efficient. In a complementary manner, Los and Lipka (2005) analysed the persistence of eight European markets, demonstrating the presence of non-linearity in the data, and the presence of long memories, except the FTSE 100. Kasman et al. (2009) investigated the long memory proprieties of Central European capital markets and discovered that the random walk hypothesis is not rejected in Hungary and the Czech Republic, while the Polish market exhibits anti persistence (short-term memory), and the Slovak capital market show the presence of long memories.

In 2018, authors Tokić et al. (2018), Żebrowska-Suchodolska and Mentel (2018), and Ferreira (2018) tested the efficiency hypothesis in Central and Eastern European markets. Tokić et al. (2018) tested the random walk hypothesis in four developing countries (Croatia, Serbia, Slovenia, Slovakia), in the period from January 2006 to December 2016 and the results showed that the markets of Croatia, Slovenia, Slovakia, are efficient, in their weak form, meanwhile, the random walk hypothesis is rejected in the market of Serbia (BELEX). Whereas the author, Żebrowska-Suchodolska and Mentel (2018) examined the efficiency hypothesis, in its weak form in the capital market of Poland (WIG) from 2010 to 2016, and found a partial (in) efficiency in the WIG stock index. Ferreira (2018) analysed the presence of long memories in 18 Eastern European markets, and concluded that most indexes are far from the absence of long-term dependencies, which can be seen as (in)efficiency. However, some countries show a decrease in dependency levels over time, namely the markets of Hungary, Czech Republic, and Poland.

Later, the authors Dias, Teixeira, et al. (2020), Dias, Heliodoro, et al. (2020), and Dias et al. (2021) examined the Efficient Market Hypothesis (EMH) in several capital markets. Dias, Teixeira, et al. (2020) examined the efficiency, in its weak form, of the capital markets of Belgium (BEL 20), France (CAC 40), Germany (DAX 30), USA (DOW JONES), Greece (FTSE Athex 20), Spain (IBEX 35), Ireland (ISEQ), Portugal (PSI 20) and China (SSE) from December 2019 to May 2020. The random walk hypothesis is rejected for the Dow Jones, SSE and PSI 20 indexes, partially rejected for the stock markets of Belgium, France, Greece, and Germany, and accepted for the IBEX 35 and ISEQ indexes, according to the authors. Dias, Heliodoro, et al. (2020) tested the random walk hypothesis in sixteen international financial markets from January 2002 to July 2019. The authors highlight the existence of mean reversion in developed and emerging markets, European and non-European, suggesting that investors with adjusted trading strategies may obtain anomalous returns. Dias et al. (2021) examined the memory properties in Eastern European capital markets from January 2016 to September 2020. The results show that the time series exhibit nonlinearity and conditional heteroscedasticity, with DFA exponents ranging from 0.64 to 0.75 over the Covid-19 period, indicating significant long memories in all markets except for the Slovak capital market (0.45).

In more recent studies, Guedes et al. (2022), Zebende et al. (2022), Dias et al. (2022), analysed if global crises had an impact on the efficiency hypothesis in international capital markets. Guedes et al. (2022) examined if the financial crisis of the last 20 years has reduced efficiency, in its weak form, in 19 capital markets belonging to the 20 most developed economies (G-20), in the period from January 2000 to February 2021. In 1000-day sliding windows, the authors show asymmetries and non-Gaussian distributions, as well as DFA exponents bigger than 0.5, indicating that capital markets are (in)efficient. In addition, the authors Zebende et al. (2022) examined the predictability of G20 capital markets; for this purpose, they divided the data into two time periods: the first period with a time scale of less than 5 days, while the second sub-period with a time scale of more than 10 days. The authors show that during the 2020 global pandemic, and for periods less than 5 days the markets tend towards efficiency, while for periods longer than 10 days, the stock markets tend to be inefficient. On the other hand, Dias et al. (2022) examined the random walk hypothesis in the capital markets of the most developed nations, such as the United States, Japan, UK, as well as emerging markets, such as Botswana, Egypt, Kenya, Morocco, Nigeria, South Africa. The authors show that markets exhibit temporal autocorrelation, i.e. past prices help explain future prices, giving rise to significant levels of arbitrage.

In summary, the purpose of this research is to help provide investors and regulators in Central and Eastern European capital markets where individual and institutional investors seek diversification benefits, as well as promoting the implementation of policies that contribute to the efficiency of these markets.

3. METHODOLOGY AND DATA

3.1. Data

Price index data for Central and Eastern European markets, namely the capital markets of Austria (Austrian Traded), Budapest (BUX), Bulgaria (SE SOFIX), Croatia (CROBEX), Russia (MOEX), Czech Republic (Prague SE PX), Romania (BET), Slovakia (SAX 16), and Slovenia (SBI TOP), were extracted from the Thomson Reuters Eikon Platform. The sample covers the period from January 1st, 2020, to May 6th, 2022. We divide the sample into three sub-periods to conduct this analysis and generate more robust results: 1st wave of Covid (January 2020 to December 2020), 2nd wave of Covid (January 2021 to December 2021), and the Russian invasion of Ukraine in 2022 (January 2022 to May 2022). To avoid exchange rate distortions, we kept the prices index in local currency.

3.2. Methodology

The research was carried out in phases. The sample was characterised through descriptive statistics and the [Jarque and Bera \(1980\)](#) test to understand whether there was a Gaussian distribution. To determine the presence or absence of unit roots in prices index we will estimate the Hadri (2000), and Levin et al. (2002) tests, which assume counterfactual unit root hypotheses. To check for conditional heteroscedasticity, we will use the Lagrange Multiplier test (ARCH-LM test) of Engle (1982), in a complementary way and to assess the linearity of a series, it is frequent to consider the BDS test, due to [Brock and de Lima \(1996\)](#). This test is an important tool to detect dependence in time series, testing the null hypothesis that a series is i.i.d. (independent and identically distributed). The authors [Brock and de Lima \(1996\)](#) concluded that when a sample with more than 500 observations is available, like in the case of the time series under consideration, this statistic follows the normal asymptotic distribution. The BDS test is a two-sided test that rejects the null hypothesis if the test statistic's value is greater than the critical value (for example, for 0.05 the corresponding critical value is ± 1.96).

The null and alternative hypotheses are developed as follows:

- H_0 The series has i.i.d. variables, indicating that the model has linear characteristics;
 H_1 The series has no i.i.d. variables, indicating that the model has non-linear characteristics.

We will use Detrended Fluctuation Analysis (DFA) to validate the results. DFA is a method of analysing time dependency in nonstationary data series. This technique by assuming that the time series are nonstationary avoids spurious results when the analysis focuses on the relationships of the data series in the long run.

Table 1. Detrended Fluctuation Analysis (DFA)

Exponent	Type of signal
$\alpha_{DFA} < 0.5$	long-range anti-persistent
$\alpha_{DFA} \approx 0.5$	uncorrelated, white noise
$\alpha_{DFA} > 0.5$	long-range persistent

Source: Own elaboration

4. RESULTS

Figure 1 shows the evolution, in terms of returns, of the stock market indexes of Austria (Austrian Traded), Budapest (BUX), Bulgaria (SE SOFIX), Croatia (CROBEX), Russia (MOEX), Czech Republic (Prague SE PX), Romania (BET), Slovakia (SAX 16) and Slovenia (SBI TOP), from January 1st, 2020, to May 6th, 2022. The graphical observations show extreme volatility during the initial wave of the global pandemic of 2020, as well as during the early months of 2022 owing to Russia's invasion of Ukraine.

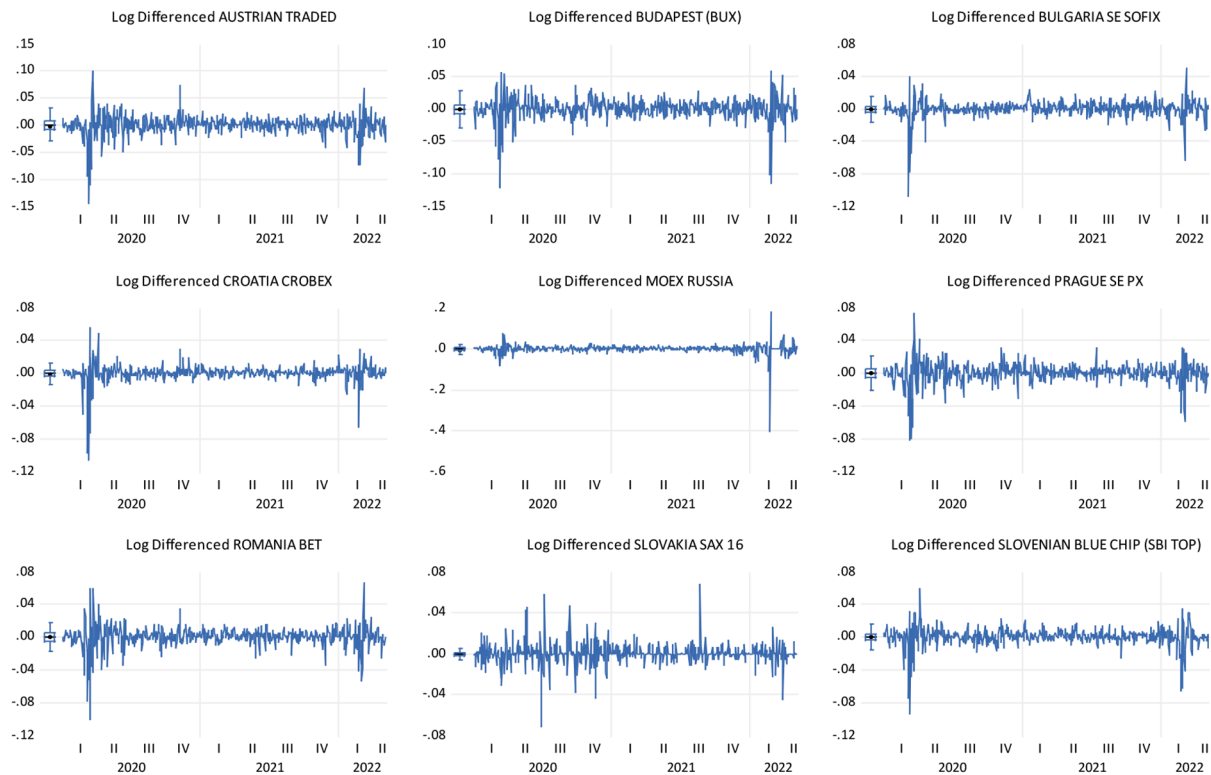


Figure 1. Evolution, in terms of returns, of the 9 financial markets for the period from January 1st, 2020, to May 6th, 2022

Source: Own elaboration

Tables 2 and 3 show descriptive statistics for the prices index (transformed into returns) of the capital markets of Austria (Austrian Traded), Budapest (BUX), Bulgaria (SE SOFIX), Croatia (CROBEX), Russia (MOEX), Czech Republic (Prague SE PX), Romania (BET), Slovakia (SAX 16) and Slovenia (SBI TOP), for the period from January 1st, 2020, to May 6th, 2022. The average returns, in their majority, are positive, with the exception made in Austria, Hungary (BUX) and Russia (MOEX). Concerning the standard deviation, we can see that the most accentuated can be observed in the Russian capital market (0.024074), which was expected.

To determine whether we are dealing with a Gaussian distribution, we observed that all asymmetries are negative and different from zero, except for the Slovak capital market - SAX 16 (0.260801), and all kurtosis measures are different from 3, with special attention paid to the Russian capital market - MOEX stock index (137.9644), indicating that we are dealing with price series that do not follow a Gaussian distribution. In a complementary way, the test of **Jarque and Bera (1980)** confirms the asymmetries and kurtosis results, where the null hypothesis that the data follow a normal distribution is rejected at a significance level of 1%.

Table 2. Descriptive statistics, in returns, of the 5 capital markets
over the period January 1st, 2020, to May 6th, 2022

	AUSTRIAN	BUDAPEST	BULGARIA	CROATIA	MOEX
Mean	-1.84E-05	-0.000131	0.000104	8.87E-05	-0.000386
Std. Dev.	0.018317	0.016888	0.010344	0.010666	0.024074
Skewness	-1.284952	-1.703397	-2.962729	-3.688366	-7.296374
Kurtosis	15.98419	14.71711	32.00575	38.96787	137.9644
Jarque-Bera	4474.733	3803.074	22385.86	34432.82	470690.2
Probability	0.000000	0.000000	0.000000	0.000000	0.000000
Observations	613	613	613	613	613

Source: Own elaboration

Table 3. Descriptive statistics, in returns, of the 4 capital markets
over the period January 1st, 2020, to May 6th, 2022

	PRAGUE	ROMANIA	SLOVAKIA	SLOVENIAN
Mean	0.000273	0.000362	0.000139	0.000353
Std. Dev.	0.012499	0.012531	0.010116	0.011319
Skewness	-1.250030	-1.370116	0.260801	-2.069020
Kurtosis	13.45179	16.55769	15.52767	19.19291
Jarque-Bera	2949.813	4886.631	4015.521	7134.647
Probability	0.000000	0.000000	0.000000	0.000000
Observations	613	613	613	613

Source: Own elaboration

For the entire sample period, tables 4 and 5 show the presence or absence of unit roots in the price series of the stock market indexes of Austria (Austrian Traded), Budapest (BUX), Bulgaria (SE SOFIX), Croatia (CROBEX), Russia (MOEX), Czech Republic (Prague SE PX), Romania (BET), Slovakia (SAX 16) and Slovenia (SBI TOP). The [Levin et al. \(2002\)](#) test postulates the presence of unit roots in the null hypothesis, and we can verify that stationarity is only achieved in first differences. We discovered that [Hadri \(2000\)](#) test, which postulates stationarity in the null hypothesis, is not rejected when we apply first differences to the prices index. Based on the findings, we can suggest that time series only approach white noise at first differences, which is required to estimate the models and answer the research question.

Table 4. Levin et al. (2002), conducted unit root testing on 9 capital markets,
from January 1st, 2020, to May 6th, 2022

Null Hypothesis: Unit root (common unit root process)

Method	Statistic					Prob.**	
Levin, Lin & Chu t*	-91.9028					0.0000	
Intermediate results on D(UNTITLED)							
Series	2nd Stage Coefficient	Variance of Reg	HAC of Dep.	Lag	Max Lag	Band-width	Obs
AUSTRIAN	-0.93164	2333.1	297.22	0	18	17.0	611
BUDAPEST	-0.87796	451961	9138.2	2	18	106.0	609
BULGARIA	-0.78946	27.598	3.4117	2	18	17.0	609
CROATIA	-0.71574	309.50	67.654	2	18	10.0	609
PRAGUE	-0.97706	162.30	3.6487	0	18	93.0	611
ROMANIA	-0.86137	14900.	1123.4	1	18	26.0	610
SLOVAKIA	-1.11957	12.773	0.2478	0	18	102.0	611
RUSSIA	-1.14144	4238.3	222.36	0	18	38.0	611
SLOVENIAN	-0.84084	118.33	27.780	1	18	7.0	610
	Coefficient	t-Stat	SE Reg	mu*	sig*		Obs
Pooled	-0.96796	-58.826	1.006	-0.500	0.500		5491

Note: ** Probabilities are computed assuming asymptotic normality.

Source: Own elaboration

Table 5. Hadri (2000) unit root tests conducted on the 9 capital markets
over the period January 1st, 2020, to May 6th, 2022

Null Hypothesis: Stationarity				
Method		Statistic		Prob.**
Hadri Z-stat		-0.02960		0.5118
Heteroscedastic Consistent Z-stat		0.42739		0.3345
Intermediate results on D(UNTITLED)				
		Variance		
Series	LM	HAC	Bandwidth	Obs
AUSTRIAN	0.1828	3735.037	11.0	612
BUDAPEST	0.1650	560588.9	8.0	612
BULGARIA	0.3160	44.39155	12.0	612
CROATIA	0.2149	621.0532	14.0	612
PRAGUE	0.2397	224.1341	9.0	612
ROMANIA	0.1402	18447.73	7.0	612
SLOVAKIA	0.0399	10.46799	2.0	612
RUSSIA	0.2779	4047.092	9.0	612
SLOVENIAN	0.1147	187.0602	11.0	612

Note: * High autocorrelation leads to severe size distortion in Hadri test, leading to over-rejection of the null.

** Probabilities are computed assuming asymptotic normality.

Source: Own elaboration

Tables 6 to 14 present the results of **Engle's (1982)** Lagrange Multiplier test (ARCH-LM test), which was applied to time series of stock indexes from Austria (Austrian Traded), Budapest (BUX), Bulgaria (SE SOFIX), Croatia (CROBEX), Russia (MOEX), Czech Republic (PragueSE PX), Romania (BET), Slovakia (SAX 16) and Slovenia (SBI TOP), for the entire sample period. The ARCH-LM test was estimated to understand whether the time series exhibit conditional heteroscedasticity and was applied to the residuals of first-order autoregressive processes. We discovered conditional heteroscedasticity in the residuals of the autoregressive processes of the capital markets under consideration for lag 10.

Table 6. Heteroskedasticity Test: ARCH, AUSTRIAN, in full period

F-statistic	2.894039	Prob. F(10,592)	0.0015
Obs*R-squared	28.10423	Prob. Chi-Square(10)	0.0017

Source: Own elaboration

Table 7. Heteroskedasticity Test: ARCH, BUDAPEST, in full period

F-statistic	2.159581	Prob. F(10,592)	0.0188
Obs*R-squared	21.22289	Prob. Chi-Square(10)	0.0196

Source: Own elaboration

Table 8. Heteroskedasticity Test: ARCH, BULGARIA, in full period

F-statistic	7.750301	Prob. F(10,592)	0.0000
Obs*R-squared	69.80449	Prob. Chi-Square(10)	0.0000

Source: Own elaboration

Table 9. Heteroskedasticity Test: ARCH, CROATIA, in full period

F-statistic	21.95968	Prob. F(10,592)	0.0000
Obs*R-squared	163.1560	Prob. Chi-Square(10)	0.0000

Source: Own elaboration

Table 10. Heteroskedasticity Test: ARCH, RUSSIA, in full period

F-statistic	2.403956	Prob. F(10,592)	0.0084
Obs*R-squared	23.53072	Prob. Chi-Square(10)	0.0089

Source: Own elaboration

Table 11. Heteroskedasticity Test: ARCH, CZECH REPUBLIC, in full period

F-statistic	19.75026	Prob. F(10,592)	0.0000
Obs*R-squared	150.8469	Prob. Chi-Square(10)	0.0000

Source: Own elaboration

Table 12. Heteroskedasticity Test: ARCH, ROMANIA, in full period

F-statistic	19.87625	Prob. F(10,592)	0.0000
Obs*R-squared	151.5674	Prob. Chi-Square(10)	0.0000

Source: Own elaboration

Table 13. Heteroskedasticity Test: ARCH, SLOVAKIA, in full period

F-statistic	2.704783	Prob. F(10,592)	0.0030
Obs*R-squared	26.34665	Prob. Chi-Square(10)	0.0033

Source: Own elaboration

Table 14. Heteroskedasticity Test: ARCH, SLOVENIAN, in full period

F-statistic	15.31049	Prob. F(10,592)	0.0000
Obs*R-squared	123.9050	Prob. Chi-Square(10)	0.0000

Source: Own elaboration

We estimate the BDS test of [Brock and de Lima \(1996\)](#) for lag 10 to validate the ARCH-LM tests applied to the residuals of first-order autoregressive processes. The test was estimated for the capital markets of Austria (Austrian Traded), Budapest (BUX), Bulgaria (SE SOFIX), Croatia (CROBEX), Russia (MOEX), Czech Republic (PragueSE PX), Romania (BET), Slovakia (SAX 16) and Slovenia (SBI TOP), for the entire sample period. The BDS test results are shown in tables 15 to 23, and we confirm the presence of non-linear components, i.e. the hypothesis that the returns are independent and identically distributed is rejected, with a statistical significance of 1%, from dimension 2 onwards, reinforcing the notion that capital market returns are non-linear or have a significant non-linear component. Additionally, the results suggest that the data's non-independence may be explained, among other things, by the presence of autocorrelation or heteroscedasticity in stock market index series, scenarios in which the rejection of the null hypothesis is explained by the data's non-linear dependency.

These results are consistent with the findings of [Vasco et al. \(2021\)](#), [Dias et al. \(2021\)](#), [Zebende et al. \(2022\)](#), [Dias et al. \(2022\)](#), and [Guedes et al. \(2022\)](#), who found autocorrelation in the data and some predictability in international financial market returns.

Table 24 shows the DFA exponents for the 9 capital markets under analysis, namely, the stock market indexes of Austria (Austrian Traded), Budapest (BUX), Bulgaria (SE SOFIX), Croatia (CROBEX), Russia (MOEX), Czech Republic (PragueSE PX), Romania (BET), Slovakia (SAX 16) and Slovenia (SBI TOP). We divide the sample into three sub-periods to test predictability: 1st wave of Covid (January 2020 to December 2020), 2nd wave of Covid (January 2021 to December 2021), and the Russian invasion in 2022 (January 2022 to May 2022).

Table 15. BDS Test for AUSTRIAN, in full period

Dimension	BDS Statistic	Std. Error	z-Statistic	Prob.	
2	0.026193	0.004106	6.379055	0.0000	
3	0.048947	0.006526	7.499921	0.0000	
4	0.067566	0.007775	8.690324	0.0000	
5	0.077652	0.008108	9.577128	0.0000	
6	0.081745	0.007824	10.44774	0.0000	
Raw epsilon		0.020149			
Pairs within epsilon		264187.0	V-Statistic	0.703057	
Triples within epsilon		1.26E+08	V-Statistic	0.545078	
Dimension	C(m,n)	c(m,n)	C(1,n-(m-1))	c(1,n-(m-1))	c(1,n-(m-1))^k
2	97057.00	0.519116	131266.0	0.702085	0.492923
3	74139.00	0.397837	131191.0	0.703984	0.348890
4	58147.00	0.313047	130744.0	0.703890	0.245481
5	46421.00	0.250740	130360.0	0.704131	0.173088
6	37625.00	0.203899	129981.0	0.704397	0.122153

Notes: The pair fraction method was used in the BDS test for a value of 0.7. The embedding dimension is referenced in the first column. The values presented in the table refer to z-Statistic. ***, ** represent significance at 1% and 5%, respectively.

Source: Own elaboration

Table 16. BDS Test for BUDAPEST, in full period

Dimension	BDS Statistic	Std. Error	z-Statistic	Prob.	
2	0.026137	0.003999	6.536212	0.0000	
3	0.048989	0.006354	7.709506	0.0000	
4	0.067521	0.007568	8.922144	0.0000	
5	0.075646	0.007890	9.587884	0.0000	
6	0.076854	0.007611	10.09758	0.0000	
Raw epsilon		0.018973			
Pairs within epsilon		264193.0	V-Statistic	0.703073	
Triples within epsilon		1.25E+08	V-Statistic	0.543774	
Dimension	C(m,n)	c(m,n)	C(1,n-(m-1))	c(1,n-(m-1))	c(1,n-(m-1))^k
2	97048.00	0.519068	131267.0	0.702090	0.492931
3	73724.00	0.395611	130906.0	0.702455	0.346622
4	57723.00	0.310765	130445.0	0.702280	0.243243
5	45829.00	0.247542	130180.0	0.703159	0.171896
6	36604.00	0.198366	129867.0	0.703779	0.121512

Notes: The pair fraction method was used in the BDS test for a value of 0.7. The embedding dimension is referenced in the first column. The values presented in the table refer to z-Statistic. ***, ** represent significance at 1% and 5%, respectively.

Source: Own elaboration

Table 17. BDS Test for BULGARIA, in full period

Dimension	BDS Statistic	Std. Error	z-Statistic	Prob.	
2	0.028768	0.004045	7.111909	0.0000	
3	0.052728	0.006442	8.184656	0.0000	
4	0.067495	0.007690	8.777056	0.0000	
5	0.070669	0.008035	8.794811	0.0000	
6	0.072529	0.007769	9.335529	0.0000	
Raw epsilon		0.010560			
Pairs within epsilon		264769.0	V-Statistic	0.704606	
Triples within epsilon		1.26E+08	V-Statistic	0.546504	
Dimension	C(m,n)	c(m,n)	C(1,n-(m-1))	c(1,n-(m-1))	c(1,n-(m-1))^k
2	97949.00	0.523887	131558.0	0.703647	0.495119
3	74658.00	0.400622	131066.0	0.703314	0.347894
4	57868.00	0.311545	130553.0	0.702861	0.244050
5	45350.00	0.244955	130540.0	0.705103	0.174286
6	35968.00	0.194919	130023.0	0.704625	0.122390

Notes: The pair fraction method was used in the BDS test for a value of 0.7. The embedding dimension is referenced in the first column. The values presented in the table refer to z-Statistic. ***, ** represent significance at 1% and 5%, respectively.

Source: Own elaboration

Table 18. BDS Test for CROATIA, in full period

Dimension	BDS Statistic	Std. Error	z-Statistic	Prob.	
2	0.038304	0.004360	8.784597	0.0000	
3	0.070616	0.006949	10.16173	0.0000	
4	0.088655	0.008302	10.67910	0.0000	
5	0.094894	0.008682	10.92986	0.0000	
6	0.094892	0.008402	11.29384	0.0000	
Raw epsilon		0.008869			
Pairs within epsilon		264745.0	V-Statistic	0.704542	
Triples within epsilon		1.27E+08	V-Statistic	0.550314	
Dimension	C(m,n)	c(m,n)	C(1,n-(m-1))	c(1,n-(m-1))	c(1,n-(m-1))^k
2	99715.00	0.533332	131546.0	0.703582	0.495028
3	78140.00	0.419307	131166.0	0.703850	0.348691
4	62007.00	0.333829	130703.0	0.703669	0.245174
5	49423.00	0.266955	130205.0	0.703294	0.172062
6	39753.00	0.215431	129693.0	0.702836	0.120538

Notes: The pair fraction method was used in the BDS test for a value of 0.7. The embedding dimension is referenced in the first column. The values presented in the table refer to z-Statistic. ***, ** represent significance at 1% and 5%, respectively.

Source: Own elaboration

Table 19. BDS Test for RUSSIA, in full period

Dimension	BDS Statistic	Std. Error	z-Statistic	Prob.	
2	-5.33E-06	0.000131	-0.040754	0.9675	
3	-1.60E-05	0.000292	-0.054861	0.9562	
4	-3.21E-05	0.000487	-0.065791	0.9475	
5	-5.35E-05	0.000712	-0.075155	0.9401	
6	-8.03E-05	0.000961	-0.083535	0.9334	
Raw epsilon		0.293647			
Pairs within epsilon		374545.0	V-Statistic	0.996743	
Triples within epsilon		2.29E+08	V-Statistic	0.995114	
Dimension	C(m,n)	c(m,n)	C(1,n-(m-1))	c(1,n-(m-1))	c(1,n-(m-1))^k
2	185745.0	0.993469	186355.0	0.996732	0.993475
3	184528.0	0.990196	185745.0	0.996727	0.990212
4	183315.0	0.986918	185136.0	0.996721	0.986950
5	182106.0	0.983634	184528.0	0.996716	0.983687
6	180901.0	0.980344	183921.0	0.996711	0.980425

Notes: The pair fraction method was used in the BDS test for a value of 0.7. The embedding dimension is referenced in the first column. The values presented in the table refer to z-Statistic. ***, ** represent significance at 1% and 5%, respectively.

Source: Own elaboration

Table 20. BDS Test for CZECH REPUBLIC, in full period

Dimension	BDS Statistic	Std. Error	z-Statistic	Prob.	
2	0.031498	0.004188	7.520733	0.0000	
3	0.062728	0.006679	9.391105	0.0000	
4	0.080050	0.007985	10.02567	0.0000	
5	0.087515	0.008355	10.47419	0.0000	
6	0.088460	0.008091	10.93363	0.0000	
Raw epsilon		0.013958			
Pairs within epsilon		265051.0	V-Statistic	0.705356	
Triples within epsilon		1.27E+08	V-Statistic	0.549331	
Dimension	C(m,n)	c(m,n)	C(1,n-(m-1))	c(1,n-(m-1))	c(1,n-(m-1))^k
2	98648.00	0.527625	131692.0	0.704363	0.496128
3	76713.00	0.411650	131195.0	0.704006	0.348922
4	60438.00	0.325382	130724.0	0.703782	0.245331
5	48144.00	0.260047	130276.0	0.703677	0.172531
6	38837.00	0.210467	129955.0	0.704256	0.122007

Notes: The pair fraction method was used in the BDS test for a value of 0.7. The embedding dimension is referenced in the first column. The values presented in the table refer to z-Statistic. ***, ** represent significance at 1% and 5%, respectively.

Source: Own elaboration

Table 21. BDS Test for ROMANIA, in full period

Dimension	BDS Statistic	Std. Error	z-Statistic	Prob.	
2	0.032603	0.004467	7.298589	0.0000	
3	0.059404	0.007128	8.333554	0.0000	
4	0.079825	0.008527	9.361788	0.0000	
5	0.093564	0.008929	10.47852	0.0000	
6	0.096276	0.008653	11.12660	0.0000	
Raw epsilon		0.012971			
Pairs within epsilon		265017.0	V-Statistic	0.705266	
Triples within epsilon		1.27E+08	V-Statistic	0.552654	
Dimension	C(m,n)	c(m,n)	C(1,n-(m-1))	c(1,n-(m-1))	c(1,n-(m-1))^k
2	98842.00	0.528663	131683.0	0.704315	0.496060
3	76049.00	0.408087	131165.0	0.703845	0.348683
4	60526.00	0.325855	130817.0	0.704283	0.246030
5	49335.00	0.266480	130334.0	0.703991	0.172916
6	40242.00	0.218081	129919.0	0.704061	0.121804

Notes: The pair fraction method was used in the BDS test for a value of 0.7. The embedding dimension is referenced in the first column. The values presented in the table refer to z-Statistic. ***, ** represent significance at 1% and 5%, respectively.

Source: Own elaboration

Table 22. BDS Test for SLOVAKIA, in full period

Dimension	BDS Statistic	Std. Error	z-Statistic	Prob.	
2	0.020037	0.005080	3.943976	0.0001	
3	0.048139	0.008102	5.941884	0.0000	
4	0.063339	0.009687	6.538465	0.0000	
5	0.068824	0.010142	6.786355	0.0000	
6	0.067565	0.009826	6.876156	0.0000	
Raw epsilon		0.010909			
Pairs within epsilon		264431.0	V-Statistic	0.703706	
Triples within epsilon		1.29E+08	V-Statistic	0.558044	
Dimension	C(m,n)	c(m,n)	C(1,n-(m-1))	c(1,n-(m-1))	c(1,n-(m-1))^k
2	96093.00	0.513960	131399.0	0.702796	0.493923
3	73542.00	0.394634	130890.0	0.702369	0.346494
4	56859.00	0.306113	130382.0	0.701941	0.242774
5	44195.00	0.238716	129875.0	0.701511	0.169892
6	34380.00	0.186313	129370.0	0.701086	0.118748

Notes: The pair fraction method was used in the BDS test for a value of 0.7. The embedding dimension is referenced in the first column. The values presented in the table refer to z-Statistic. ***, ** represent significance at 1% and 5%, respectively.

Source: Own elaboration

Table 23. BDS Test for SLOVENIAN, in full period

Dimension	BDS Statistic	Std. Error	z-Statistic	Prob.	
2	0.049888	0.004498	11.09045	0.0000	
3	0.087898	0.007174	12.25236	0.0000	
4	0.108281	0.008577	12.62512	0.0000	
5	0.117964	0.008976	13.14150	0.0000	
6	0.119596	0.008694	13.75631	0.0000	
Raw epsilon		0.011845			
Pairs within epsilon		264841.0	V-Statistic	0.704797	
Triples within epsilon		1.27E+08	V-Statistic	0.552380	
Dimension	C(m,n)	c(m,n)	C(1,n-(m-1))	c(1,n-(m-1))	c(1,n-(m-1))^k
2	102405.0	0.547720	131918.0	0.705572	0.497832
3	81709.00	0.438459	131400.0	0.705106	0.350560
4	65964.00	0.355132	130926.0	0.704870	0.246851
5	53963.00	0.291478	130424.0	0.704477	0.173513
6	44540.00	0.241373	129914.0	0.704034	0.121776

Notes: The pair fraction method was used in the BDS test for a value of 0.7. The embedding dimension is referenced in the first column. The values presented in the table refer to z-Statistic. ***, ** represent significance at 1% and 5%, respectively.

Source: Own elaboration

Table 24. Results, in returns, of the exponent of DFA

Stock market	DFA (1 st wave)	DFA (2 nd wave)	DFA (invasion)
Austria	$0.67 \cong 0.0022^{***}$	$0.36 \cong 0.0044^{***}$	$0.51 \cong 0.0161$
Hungary	$0.60 \cong 0.0095^{***}$	$0.45 \cong 0.0075^{***}$	$0.50 \cong 0.0249$
Bulgaria	$0.68 \cong 0.0010^{***}$	$0.45 \cong 0.0115$	$0.55 \cong 0.0017^{***}$
Croatia	$0.72 \cong 0.0011^{***}$	$0.54 \cong 0.0013^{***}$	$0.51 \cong 0.0161$
Russia	$0.62 \cong 0.0032^{***}$	$0.37 \cong 0.0074^{***}$	$0.43 \cong 0.0105$
Czech Republic	$0.65 \cong 0.0056^{***}$	$0.47 \cong 0.0002^{***}$	$0.43 \cong 0.0176$
Romania	$0.61 \cong 0.0021^{***}$	$0.46 \cong 0.0086^{***}$	$0.65 \cong 0.0010^{***}$
Slovakian	$0.52 \cong 0.0048^{***}$	$0.41 \cong 0.0007^{***}$	$0.31 \cong 0.0041^{***}$
Slovenia	$0.66 \cong 0.0011^{***}$	$0.57 \cong 0.0001^{***}$	$0.60 \cong 0.0016^{***}$

Note: The adjustment of α DFA model has an $R^2 > 0.99$. ***, **, *. represent significance at 1%, 5% and 10%, respectively.

Source: Own elaboration

In the first wave period, we can see that all markets show signs of predictability and long memory, with the capital markets of Croatia (0.72), Bulgaria (0.68), Austria (0.67), Slovenia (0.66), Czech Republic (0.65), Russia (0.62), Romania (0.61), Hungary (0.60), and Slovakia (0.52) standing out. These findings show that previous prices can help predict future prices and that the data is not i.i.d., implying that investors can get above-market returns without taking on additional risk.

Throughout the subperiod of the second wave of the global pandemic, we find a significant shift in the predictability of these capital markets that is, most markets show evidence of anti-persistence, and of short-term memories. The Bulgarian market exhibits signals of equilibrium since the random walk hypothesis is not rejected, but the markets of Croatia (0.54) and Slovenia (0.57), on the other hand, reject the equilibrium hypothesis and show persistence in their returns. Czech Republic (0.47), Romania (0.46), Hungary (0.45), Slovakia (0.41), Russia (0.37), Austria (0.36) capital markets exhibit evidence of anti-persistence, that is, they adjusted when compared to the preceding period.

Already during Russia's invasion of Ukraine in 2022, we can see that the war event had a minor impact when compared to the first wave of the global pandemic in 2020; put it another way, the capital markets of Austria, Hungary, Croatia, Russia, Czech Republic do not reject the random walk hypothesis and are in equilibrium.

The markets of Romania (0.65), Slovenia (0.60), and Bulgaria (0.55) show signs of predictability in their returns, with the Romanian stock index showing more signs of persistence as compared to the first wave of Covid-19, while the Slovakian market exhibits signs of anti-persistence.

These findings are relevant to the existing literature as they highlight that these regional markets reacted differently to the events of the Covid-19 pandemic and the Russian invasion in 2022, showing that investors are unlikely to get above-market profits without incurring additional risk most of the time.

5. CONCLUSION

This paper examined the predictability of capital market returns in Austria (Austrian Traded), Budapest (BUX), Bulgaria (SE SOFIX), Croatia (CROBEX), Russia (MOEX), Czech Republic (PragueSE PX), Romania (BET), Slovakia (SAX 16), and Slovenia (SBI TOP) for the period

January 1st, 2020, to May 6th, 2022. We partitioned the sample into three sub-periods to conduct this analysis and obtain more robust results: 1st wave of Covid (January 2020 to December 2020), 2nd wave of Covid (January 2021 to December 2021), and the Russian invasion in 2022 (January 2022 to May 2022).

Engle's (1982) Lagrange Multiplier test (ARCH-LM test) results reveal that the residual of the autoregressive processes of the capital markets under consideration exhibit conditional heteroscedasticity. Furthermore, the BDS test results indicate the presence of non-linear components, i.e. the hypothesis that the returns are independent and identically distributed is rejected, with a statistical significance of 1%, from dimension 2 onwards, reinforcing the notion that capital market returns are non-linear or have a significant non-linear component.

The DFA exponent results, referring to the first wave of Covid-19, show that all markets exhibit signs of predictability and long memories, particularly the Croatian capital market (0.72). These findings suggest that past prices help predict future prices and that data are not i.i.d. In terms of the second wave of Covid-19, we find a dramatic shift in the predictability of these capital markets, i.e. the markets exhibit anti-persistence and short-term memory for most of the time. The Bulgarian market appears to be in equilibrium since the random walk hypothesis is not rejected; however, the Croatian (0.54) and Slovenian (0.57) markets reject the equilibrium hypothesis and exhibit persistence in their returns, while the remaining markets show signs of anti-persistence. During the Russian invasion of Ukraine in 2022, we verified that the war event had a lower impact when compared to the first wave of the global pandemic in 2020; the capital markets of Austria, Hungary, Croatia, Russia, and the Czech Republic do not reject the random walk hypothesis being in equilibrium. The markets of Romania (0.65), Slovenia (0.60) and Bulgaria (0.55) exhibit signs of predictability in their returns, with the Romanian stock index exhibiting higher persistence as compared to the first wave of Covid-19, while the Slovakian market exhibits anti-persistence.

The general conclusion to retain, supported by the results of the tests performed with econometric and econophysical models, is that the Russian invasion of Ukraine in 2022 had a different impact on the predictability of these regional markets, that is, markets were predictable and showed pronounced long memories during the first wave of Covid-19, whereas markets tended towards equilibrium in the last sub-period of 2022. The authors believe that this research is crucial for policymakers and investors in Central and Eastern European capital markets in terms of regional development initiatives and portfolio diversification strategies.

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Linear and Nonlinear Effects on Connectivity Structure: A Comparison of European Stock Markets

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Abstract: Understanding how crises spread is important for policymakers and regulators to take appropriate measures to prevent or contain crisis spread. This paper aims to analyse the synchronisations and financial contagion between the capital markets of Austria (ATX), Hungary (BUX), Croatia (CROBEX), Serbia (BELEX 15), Russia (IMOEX), Czech Republic (Prague SE PX), Slovenia (SBI TOP), and Poland (WIG) from September 19th, 2017, to September 15th, 2022. The results show that during the Tranquil period, there were 23 integrations (out of 49 possibilities), and the markets with the most integrations are the Russian (IMOEX) and Polish (WIG) capital markets, while the Slovenian market (SBI TOP) does not integrate with any market, suggesting some isolation from its regional peers. During the 2020 and 2022 Stress events, we can confirm the presence of 45 integrations, with the stock indexes ATX, BUX, IMOEX, and SBI TOP being the most integrated markets (7 out of 7 possibilities). These findings are supported by the results of the unconditional correlations, which show that the coefficients significantly increased between the Tranquil and Stress periods. To validate, the Forbes and Rigobon's t-test shows that we are witnessing the phenomenon of marked contagion in these regional markets, with the exception of the IMOEX-CROBEX pair. These findings suggest that regional investors operating in these markets may have some challenges in mitigating portfolio risk, with a high probability of possible losses in their portfolios.

1. INTRODUCTION

Many different ways in which financial crises spread across countries are described in the literature. One of the main fields of research has been the transmission of shocks during times of crisis. Although various definitions of financial contagion are suited to the individual character of each research, we will use Forbes and Rigobon's (2002) definition: "...it is a considerable rise in links across markets following a shock in one country (or group of countries)...". Financial contagion occurs when the correlation between the returns of two markets increases statistically significantly following an unexpected occurrence. This research method is thought to be the most appropriate, and it was used in this study.

International financial integration can help to diversify risks, but it can also spread crises across borders; specifically, this phenomenon leads to a significant increase in global leverage, a significant increase in the likelihood of crises in any market, and a dramatic improvement in the

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degree of "contagion" between financial markets (Dias, da Silva, et al., 2019; Dias, Pardal, et al., 2020; Dias and Carvalho, 2021; Pardal et al., 2021).

Several studies have been conducted to investigate the influence of exogenous shocks on financial markets in order to better understand market synchronization and portfolio diversification in foreign markets. In general, investors, risk managers, national regulators, and international financial institutions are interested in learning how the phenomena of contagion and interdependence emerge as a result of the negative effects of exogenous shocks on national financial markets (Dias & Pereira, 2021; Dias et al., 2021a, 2021b).

Certain mechanisms by which an external shock propagates between two capital markets have been highlighted in the literature on financial markets. As a result, various studies have been conducted to identify links between international financial markets, as well as to identify contagion causes and the phenomenon of capital market co-movements (Dias, Pardal, et al., 2022; Dias, Pereira, et al., 2022; Horta, Dias, Revez & Alexandre, 2022; Horta, Dias, Revez, Heliodoro, et al., 2022; Teixeira, Dias, Pardal, & Horta, 2022).

Due to global economic uncertainty, the events of 2020 and 2022 had a negative impact on international financial markets. In this context, the purpose of this research is to evaluate the synchronizations and financial contagion between the capital markets of Austria (ATX), Serbia (BELEX 15), Hungary (BUX), Croatia (CROBEX), Russia (IMOEX), Czech Republic (PRAGUE PX), Slovenia (SBI TOP), and Poland (WIG) from September 18th, 2017, to September 15th, 2022. The findings suggest that markets in these regional markets have integrated exponentially throughout the Stress period, but they also exhibit signals of severe contagion, casting risk mitigation and the possibility of probable losses in their portfolios into doubt.

This research work is divided into 5 sections. In addition to the current introduction, section 2 presents a Literature Review as regards articles on synchronisation and contagion between international capital markets, section 3 describes the methodology and data, section 4 contains the results. Section 5 presents the general discussions of the work.

2. LITERATURE REVIEW

Given the events of 2020 and 2022, it is becoming increasingly crucial to analyse if market synchronisations have caused shocks/contagion between them. Investors must understand the nature and extent of interdependence across financial markets in order to make effective hedging decisions and reduce the negative impact of uncertainty on expected return on investment. Similarly, knowing the interdependent relationships across international stock markets makes it easier to identify diversification possibilities (Dias, Pardal, et al., 2022; Dias, Pereira, et al., 2022; Guedes et al., 2022; Horta, Dias, Revez, & Alexandre, 2022; Horta, Dias, Revez, Heliodoro, et al., 2022; Teixeira, Dias, Pardal, & Horta, 2022; Zebende et al., 2022).

Horvath and Petrovski (2012) examined the synchronisations between Western European, Central European, and Southeast European markets from 2006 to 2011, demonstrating the existence of considerable contagion across Central European markets. Furthermore, they reveal that contagion is lower in Western European and South-Eastern European markets, suggesting the presence of efficient diversification strategies.

Özer et al. (2016) examined the capital market synchronisations of Austria, Czech Republic, Croatia, Lithuania, Germany, and Greece, suggesting the lack of shocks between the markets studied. These findings have relevant implications for international investors, portfolio managers, and policymakers. In the same line of research, the authors' Jin and An (2016) studied the contagion effects between the BRIC capital markets and the US market, revealing that there was contagion between the stock markets evaluated during the 2008 financial crisis. Tsai (2017) investigated the capital markets of Europe, China, Japan, and the United States, implying the existence of partial contagion between the nations surveyed.

Alexakis and Pappas (2018) highlight the existence of significant financial contagion in Europe's capital markets during the 2008 and 2010 financial crises; these results show that portfolio diversification and risk mitigation will be minimal. The authors Chevallier, Nguyen, Siverskog, and Uddin (2018), on the other hand, show that the synchronization of ASEAN capital markets is driven by greater exposure to US shocks than to shocks affecting developed economies in East Asia. In other words, the interdependence of markets in the Pacific Basin region has grown stronger over time, potentially reducing the benefit of regional diversification strategies, and exposing countries in the region to increased contagion risk.

In 2020, authors Yuan et al. (2020) evidenced the existence of significant contagion between the capital markets of China, Japan, and the US during the crash in China in 2016. Gunay (2020) verified contagion in six capital markets during the Covid-19 pandemic, suggesting the occurrence of contagion and structure breakdowns between February 19th, 2020, and February 21st, 2020, in most markets, while in China's market, the breakdown happened on January 30th, 2020. In addition, authors Zheng et al. (2020) demonstrate that short-term shocks can influence both long-term relationships and changes in correlation coefficients with a lag, i.e., an accumulation of short-term shocks can create a long-term trend, which helps to explain the phenomenon of contagion on long-term scales.

Shi (2022) explored the contagion between China's capital markets and twelve markets in the Asia-Pacific region following the 2008 financial crisis in more recent research. Contagion was strong among the markets studied during the Shanghai stock market fall, the US-China tariff war, and the Covid-19 outbreak, according to the author. In addition, from February 2018 to November 2021, the authors Horta, Dias, Revez, Heliodoro, et al. (2022) evaluated the shocks between the G7 capital markets and the cryptocurrencies Bitcoin (BTC), Litecoin (LTC), Ethereum (ETH), and Crypto 10 Index. When compared to the pre-Covid subperiod, the authors find that the cryptocurrencies BTC, ETH, and LTC increased shocks to each other, although the Crypto 10 index decreased the quantity of shocks. In terms of capital markets, the DJ maintained the level of shocks, but the Nikkei 225 retreated, while shocks increased significantly in comparison to the other capital markets under consideration during the 2020 worldwide pandemic. The authors Teixeira, Dias, Pardal, and Horta (2022) evaluated the synchronisation between the capital markets of Germany (DAX), USA (Dow Jones), France (CAC 40), United Kingdom (FTSE 100), Italy (FTSE MIB), Russia (MOEX), Japan (NIKKEI 225), and Canada (S&P TSX), China (Shanghai and Shenzhen) and the oil markets of the US (AMERICAS-DS OIL), Asia (ASIA-DS OIL), Canada (CANADA-DS OIL), Emirates (EMU-DS OIL), China (CHINA-DS OIL), Nigeria (NIGERIA-DS OIL), and the UK (UK-DS OIL), during the 2020 and 2022 events. The authors show that long-term relationships between capital markets and oil markets do not help explain short-term movements.

In essence, the purpose of this study is to help investors and regulators in Central and Eastern European capital markets where individual and institutional investors seek diversification benefits. As a result, the purpose of this research is to investigate the synchronizations between European capital markets and to determine if the notion of portfolio diversification is challenged as a result of global economic uncertainty.

3. METHODOLOGY AND DATA

3.1. Data

The data examined are the capital market pricing indexes of Austria (ATX), Serbia (BELEX 15), Hungary (BUX), Croatia (CROBEX), Russia (IMOEX), Czech Republic (PX PRAGUE), Slovenia (SBITOP), and Poland (WIG) from September 18th, 2017, to September 15th, 2022. The sample was divided into two sub-periods: the Tranquil period (September 18th, 2017, to December 30th, of 2019), and the Stress period (January 2nd, 2020, to September 15th, 2022). The quotations are obtained daily using the DataStream platform and are in local currency to avoid exchange rate distortions.

Table 1. The name of countries and their indexes used in this paper

Country	Index
Austria	ATX
Serbia	BELEX 15
Hungary	BUX
Croatia	CROBEX
Russia	IMOEX
Czech Republic	PX PRAGUE
Slovenia	SBITOP
Poland	WIG

Source: Own elaboration

3.2. Methodology

The research will proceed in stages. In the first step, we will create graphs, in returns, to comprehend market fluctuation as well as dispersion about the average. In the following phase, a summary of descriptive statistics such as the mean, standard deviation, asymmetry, and kurtosis will be utilized to characterize the sample. To determine if temporal data follows a white noise, we will employ the tests of [Hadri \(2000\)](#) and [Levin et al. \(2002\)](#), which postulate opposing assumptions of stationarity. To test stability, we will graph the recursive residuals of each time series, and to check market synchronisation, we will use the [Gregory and Hansen \(1996\)](#) approach. To examine the occurrence of financial contagion between European capital markets, we will estimate unconditional correlations. One method for testing the statistical significance of the correlation coefficient is to use the t-statistic, which follows the t-distribution with $n - 2$ degrees of freedom, where r is the correlation coefficient between two series and n is the number of observations. In order to understand if the generalized increase in correlations was statistically significant, the [Forbes and Rigobon \(2002\)](#) t-test for two-sample heteroscedasticity will be applied. This type of correlation requires a transformation by Fisher's method.

4. RESULTS

Figure 1 shows the evolution of Austria's (ATX), Hungary's (BUX), Croatia's (CROBEX), Serbia's (BELEX 15), Russia's (IMOEX), Czech Republic's (Prague SE PX), Slovenia's (SBI TOP), and Poland's (WIG) capital markets from September 17th, 2019, to September 15th, 2022. This period was defined mostly by two events that had a negative impact on the world economy, namely the 2020 pandemic and Russia's invasion of Ukraine in 2022. We can confirm the presence of a significant dispersion concerning the market average; this phenomenon is connected to the loss of confidence of specific investors during moments of stress in the capital markets.

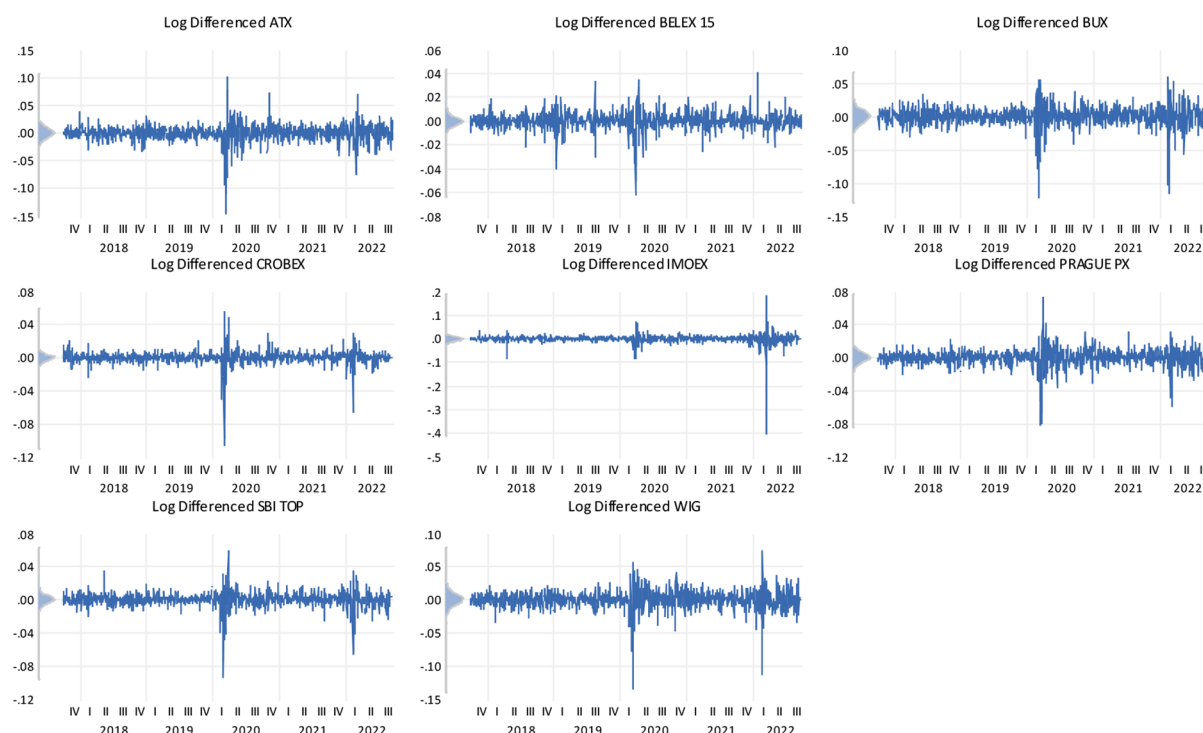


Figure 1. Evolution, in first differences (logarithmic function), of the 8 capital markets for the period from September 19th, 2017, to September 15th, 2022

Source: Own elaboration Note: Data processed by the authors (software: Eviews12).

In Table 2 we can observe the summary table of the main descriptive statistics to ascertain whether the time data follow Gaussian distributions, for the capital markets of Austria (ATX), Hungary (BUX), Croatia (CROBEX), Serbia (BELEX 15), Russia (IMOEX), Czech Republic (Prague SE PX), Slovenia (SBI TOP), and Poland (WIG) from September 17th, 2019, to September 15th, of 2022. When we examine the results, we see that the average returns of all stock market indexes are positive, except for the ATX and WIG stock market indexes, and that the IMOEX index has the highest risk value (0.018450), while the BELEX 15 index has the least volatility (0.006947). The asymmetries are skewed and negative, with a particular emphasis on the Russian stock market index (-8.081235), while the shorts exceed 3, implying that the time series data follow a leptokurtic distribution. The indexes with the highest and lowest kurtosis values were determined as IMOEX (196.4023) and BELEX 15 (15.33660).

The statistical test of [Jarque and Bera \(1980\)](#) validates these findings since the probability for each of the 8 capital markets leads us to reject the null hypothesis that postulates normality.

Table 2. Descriptive statistics of the 8 capital markets
for the period from September 19th, 2017, to September 15th, 2022

	ATX	BELEX 15	BUX	CROBEX	IMOEX	PRAGUE	SBI TOP	WIG
Mean	-8.49E-05	0.000117	5.49E-05	7.80E-05	0.000137	0.000137	0.000291	-0.000195
Std. Dev.	0.014819	0.006947	0.014134	0.008240	0.018450	0.010112	0.009027	0.013147
Skewness	-1.231871	-1.068310	-1.477502	-3.907048	-8.081235	-1.194789	-1.980833	-1.403024
Kurtosis	18.69780	15.33660	15.46578	53.60873	196.4023	15.81751	23.65061	18.53894
Jarque-Bera	13224.21	8210.143	8596.194	137343.2	1972739.	8903.676	23157.21	13058.80
Probability	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000
Observations	1257	1257	1257	1257	1257	1257	1257	1257

Source: Own elaboration Note: Data processed by the authors (software: Eviews12)

Table 3. Levin, Lin, and Chu stationarity test (2002), applied to the 8 capital markets
for the period from September 19th, 2017, to September 15th, 2022

Null Hypothesis: Unit root (common unit root process)							
Method					Statistic	Prob.**	
Levin, Lin & Chu t*					-102.439	0.0000	
** Probabilities are computed assuming asymptotic normality							
Intermediate results on D(UNTITLED)							
Series	2nd Stage Coefficient	Variance of Reg	HAC of Dep.	Lag	Max Lag	Band-width	Obs
ATX	-0.94616	1686.0	41.975	0	22	84.0	1255
BELEX 15	-0.93055	25.926	0.1354	1	22	449.0	1254
BUX	-0.93246	318915	6582.7	2	22	99.0	1253
CROBEX	-0.74483	196.42	2.5436	2	22	224.0	1253
IMOEX	-1.10427	2402.4	51.195	0	22	96.0	1255
PRAGUE PX	-0.96135	113.03	11.238	0	22	19.0	1255
SBI TOP	-0.85583	73.969	1.4256	1	22	110.0	1254
WIG	-0.98592	516307	4940.7	0	22	215.0	1255
	Coefficient	t-Stat	SE Reg	mu*	sig*		Obs
Pooled	-0.96068	-81.182	1.003	-0.500	0.707		10034

Source: Own elaboration Note: Data processed by the authors (software: Eviews12)

Table 4. Hadri stationarity test (2000), applied to the 8 capital markets
for the period from September 19th, 2017, to September 15th, 2022

Null Hypothesis: Stationarity				
Method	Statistic			Prob.**
Hadri Z-stat	-1.72956			0.9581
Heteroscedastic Consistent Z-stat	-1.52989			0.9370
* Note: High autocorrelation leads to severe size distortion in Hadri test, leading to over-rejection of the null				
** Probabilities are computed assuming asymptotic normality				
Intermediate results on D(UNTITLED)				
Series	LM	Variance HAC	Bandwidth	Obs
ATX	0.0710	2476.314	13.0	1256
BELEX 15	0.0713	35.12394	14.0	1256
BUX	0.0600	345869.5	5.0	1256
CROBEX	0.0461	350.4808	17.0	1256
IMOEX	0.2055	2326.372	8.0	1256
PRAGUE PX	0.0924	155.2372	14.0	1256
SBI TOP	0.0578	119.1977	14.0	1256
WIG)	0.0841	591264.5	9.0	1256

Source: Own elaboration Note: Data processed by the authors (software: Eviews12)

Tables 3 and 4 provide the findings for the stationarity of the time series in the first differences, which is required to confirm the lack of unit roots in the European capital markets' time series. Levin et al. (2002) reject the unit root hypothesis, however, the Hadri (2000) test, which

postulates a counterfactual hypothesis, demonstrates that the stationarity hypothesis is not rejected, indicating that we may be dealing with white noise. Regarding the removal of unit roots in time data, Dias, Pardal, et al. (2022); Guedes et al. (2022); Horta, Dias, Revez, Heliodoro, et al. (2022); and Teixeira, Dias, Pardal, and Horta (2022) all confirm these assumptions.

Figure 2 shows the recursive residual plots for each time series, and it can be seen that all tests have values that exceed the crucial bands of the 95 percent confidence interval (shown in red colour), suggesting an unstable behaviour.

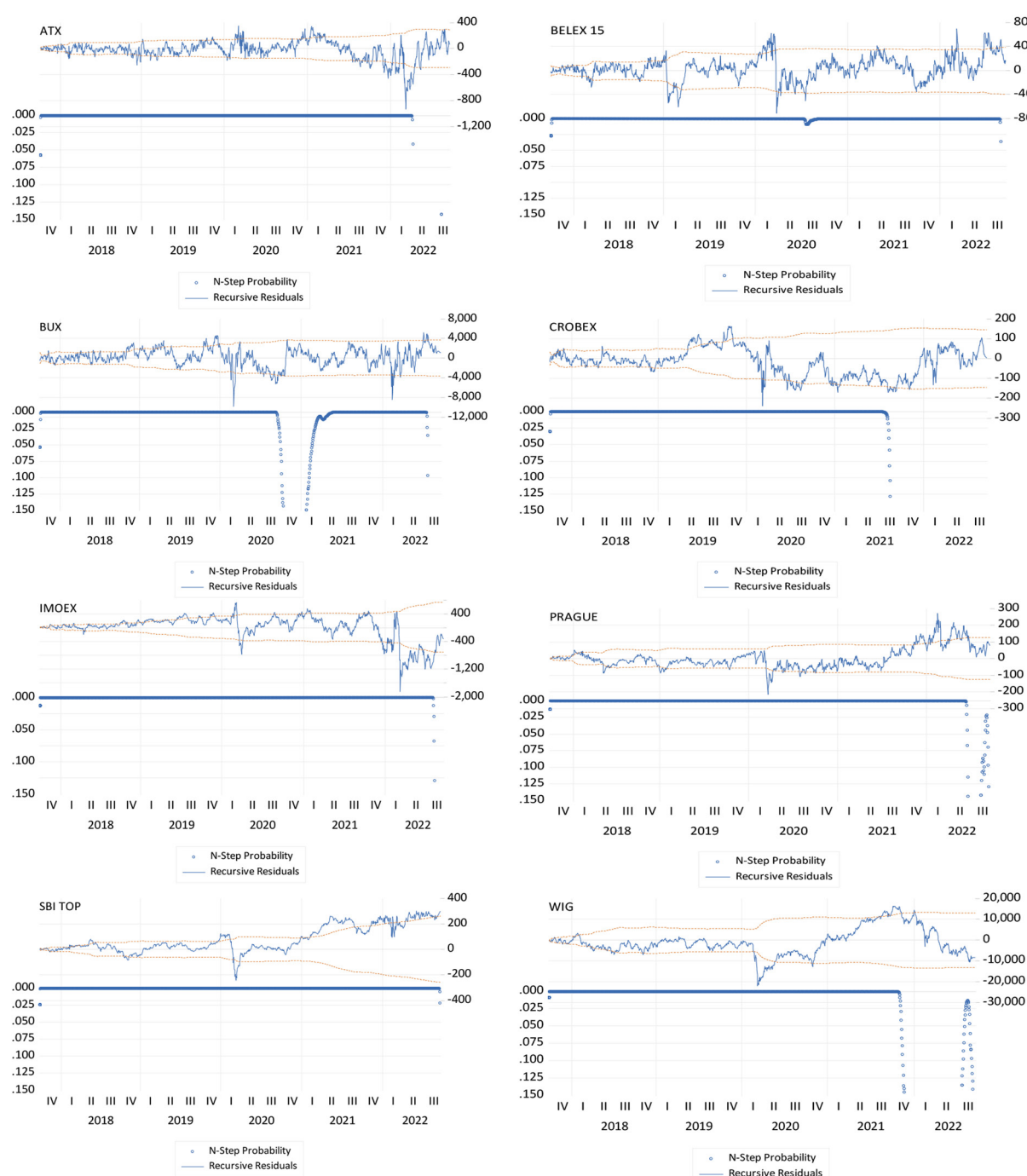


Figure 2. Stability Tests conducted on results of the 8 capital markets for the period from September 19th, 2017, to September 15th, 2022

Source: Own elaboration Note: Data processed by the authors (software: Eviews12)

Two structural breaks are conceivable, in March 2020 (Covid-19 pandemic) and between the first and second quarters of 2022 (Russia-Ukraine conflict). This evidence may also be found in the work of authors [Teixeira, Dias, Pardal, and Horta \(2022\)](#), [Dias, Pardal, et al. \(2022\)](#), who demonstrate the presence of significant structural breaks during the 2020 and 2022 occurrences.

Table 5 exhibits the findings of the [Gregory and Hansen \(1996\)](#) test conducted to the capital markets of Austria (ATX), Hungary (BUX), Croatia (CROBEX), Serbia (BELEX 15), Russia (IMOEX), Czech Republic (Prague SE PX), Slovenia (SBI TOP), and Poland (WIG) from 19th of September of 2017 to 31st of December of 2019.

During the Quiet Period, there were 23 integrations (out of 49 possibilities) globally, with the capital markets of Russia (IMOEX) and Poland (WIG) having the most integrations (6 out of 7 possibilities). The Austrian (ATX) and Hungarian (BUX) markets were in the middle, with the same number of integrations (4 out of 7 possibilities), followed by the Croatian market (CROBEX), which had two integrations out of seven available. In contrast, the Czech (PRAGUE PX) and Serbian (BELEX 15) markets have a single integration, whilst the Slovenian market (SBI TOP) has none, showing significant isolation from the other markets under analysis.

These findings are supported by [Dias et al. \(2019\)](#), [Dias et al. \(2020\)](#), [Pardal, P., Dias, R., Šuleř, P., Teixeira, N., and Krulický \(2020\)](#), [Silva et al. \(2020\)](#), and [Pardal et al. \(2021\)](#), who note that markets tend to segment during periods of apparent calm in international financial markets.

Table 5. [Gregory and Hansen \(1996\)](#) test, relating to the 8 capital markets in the Tranquil period

Market	Test	Test Statistic	Method	Lags	Breakpoint Date
ATX - BUX	Zt	-5,53***	Regime	3	07/11/2018
ATX - CROBEX	Zt	-5,64***	Regime	3	14/05/2019
ATX - PRAGUE	Zt	-6,07***	Regime	0	12/10/2018
ATX - WIG	Zt	-5,27**	Trend	0	27/11/2018
BUX - ATX	Za	-47,92**	Regime	0	07/11/2018
BUX - SBI TOP	Zt	-4,85*	Regime	1	16/01/2019
BUX - CROBEX	Zt	-4,78*	Trend	1	07/11/2018
BUX - WIG	Zt	-4,74*	Trend	0	08/05/2018
CROBEX - ATX	Zt	-5,17**	Trend	3	14/05/2019
CROBEX - IMOEX	Zt	-5,49***	Regime	3	07/11/2018
IMOEX - ATX	ADF	-5,76***	Trend	5	04/06/2019
IMOEX - SBI TOP	Zt	-5,24**	Trend	5	12/04/2018
IMOEX - BUX	ADF	-5,3**	Trend	5	08/11/2018
IMOEX - CROBEX	Zt	-5,13**	Trend	1	01/08/2019
IMOEX - PRAGUE	Zt	-5,83***	Trend	0	04/06/2019
IMOEX - WIG	ADF	-4,82*	Trend	5	07/06/2019
PRAGUE - ATX	Zt	-6,16***	Trend	0	23/08/2019
WIG - ATX	Zt	-5,51***	Trend	0	27/11/2018
WIG - BELEX	ADF	-5,17**	Trend	4	10/01/2019
WIG - SBI TOP	Zt	-4,73*	Trend	4	06/03/2018
WIG - BUX	Zt	-5,45**	Trend	3	22/01/2019
WIG - CROBEX	ADF	-5,22**	Trend	5	10/12/2018
WIG - IMOEX	Zt	-5,61***	Trend	5	10/12/2018

Note: Data processed by the authors (software: Stata). The critical values are found in Gregory and Hansen (1996). The critical values for the ADF and Zt parameters are: -5,45 (1%); -4,99 (5%); -4,72 (10%). For the Za parameter, the critical values are: -57,28 (1%); -47,96 (5%); -43,22 (10%). The asterisks ***, **, * indicate statistical significance at 1%, 5% and 10%, respectively.

Source: Own elaboration

Table 6. Gregory and Hansen (1996) test, relating to the 8 capital markets in the Stress period

Market	Test	Test Statistic	Method	Lags	Breakpoint Date
ATX - BELEX 15	Zt	-5,67***	Trend	4	23/02/2022
ATX - SBI TOP	Zt	-5,75***	Trend	2	11/11/2020
ATX - BUX	Zt	-5,24**	Trend	4	20/01/2022
ATX - CROBEX	Zt	-6,37***	Trend	3	24/02/2022
ATX - IMOEX	ADF	-5,21**	Trend	4	09/03/2022
ATX - PRAGUE	Za	-63,9***	Trend	1	14/09/2021
ATX - WIG	Zt	-5,15**	Trend	0	04/06/2020
BELEX - ATX	Zt	-5,28**	Trend	4	23/02/2022
BELEX - CROBEX	ADF	-5,92***	Trend	5	29/05/2020
SBI TOP - ATX	Zt	-5,8***	Trend	2	22/04/2021
SBI TOP - BELEX	ADF	-5,14**	Trend	5	31/01/2022
SBI TOP - BUX	Zt	-4,94*	Trend	0	20/10/2020
SBI TOP - CROBEX	Zt	-4,77*	Trend	5	14/02/2022
SBI TOP - IMOEX	ADF	-5,31**	Trend	5	08/03/2022
SBI TOP - PRAGUE	ADF	-5,73***	Trend	5	28/01/2022
SBI TOP - WIG	Zt	-5,93***	Trend	4	08/07/2020
BUX - ATX	Zt	-5,86***	Trend	5	20/01/2022
BUX - BELEX	ADF	-5,43**	Trend	4	28/01/2022
BUX - SBI TOP	Zt	-5,18**	Trend	0	20/10/2020
BUX - CROBEX	Zt	-5,61***	Trend	3	28/01/2022
BUX - IMOEX	ADF	-5,65***	Trend	5	15/03/2022
BUX - PRAGUE	ADF	-5,83***	Trend	4	28/01/2022
BUX - WIG	Zt	-5,89***	Trend	5	21/04/2022
CROBEX - ATX	Zt	-6,23***	Trend	3	24/02/2022
CROBEX - BELEX	ADF	-5,98***	Trend	5	24/01/2022
CROBEX - BUX	Zt	-5**	Trend	3	27/01/2022
CROBEX - IMOEX	ADF	-5,48***	Trend	5	11/02/2022
CROBEX PRAGUE	ADF	-5,82***	Trend	3	15/07/2021
IMOEX - ATX	Zt	-5,8***	Regime	4	09/03/2022
IMOEX - BELEX	Zt	-5,49***	Trend	3	28/02/2022
IMOEX - SBI TOP	Zt	-5,61***	Trend	5	08/03/2022
IMOEX - BUX	Zt	-6,21***	Trend	5	09/03/2022
IMOEX - CROBEX	Zt	-5,84***	Trend	5	28/02/2022
IMOEX - PRAGUE	Zt	-5,68***	Trend	5	25/02/2022
IMOEX - WIG	Zt	-6,59***	Trend	5	09/03/2022
PRAGUE - ATX	Zt	-5,6***	Trend	1	14/09/2021
PRAGUE - SBI TOP	ADF	-5,39**	Trend	3	09/09/2021
PRAGUE - BUX	ADF	-5,4**	Trend	3	09/11/2021
PRAGUE - CROBEX	ADF	-5,5***	Trend	3	15/07/2021
PRAGUE - WIG	Zt	-5,79***	Trend	1	11/11/2021
WIG - ATX	Zt	-5,09**	Trend	0	04/06/2020
WIG - SBI TOP	Zt	-5,8***	Trend	0	08/07/2020
WIG - BUX	Zt	-6,07***	Trend	5	21/04/2022
WIG - IMOEX	ADF	-5,64***	Trend	4	24/02/2022
WIG - PRAGUE	Zt	-5,72***	Trend	0	11/11/2021

Note: Data processed by the authors (software: Stata). The critical values are found in Gregory and Hansen (1996). The critical values for the ADF and Zt parameters are: -5,45 (1%); -4,99 (5%); -4,72 (10%). For the Za parameter, the critical values are: -57,28 (1%); -47,96 (5%); -43,22 (10%). The asterisks ***, **, * indicate statistical significance at 1%, 5% and 10%, respectively.

Source: Own elaboration

Table 6 shows the results obtained for the capital markets of Austria (ATX), Hungary (BUX), Croatia (CROBEX), Serbia (BELEX 15), Russia (IMOEX), Czech Republic (Prague SE PX),

Slovenia (SBI TOP), and Poland (WIG) during the Stress Period, which lasted from 1st of January 1st, 2020, to September 15th, 2022.

The number of integrations in all capital markets studied increased significantly during the Stress Period, with the exception of the Polish stock market index (WIG), which recorded one less integration in comparison to the Quiet Period (5 out of 7 possible). During this time, the majority of stock markets, especially ATX, BUX, IMOEX, and SBI TOP, have become more integrated, incorporating as many as feasible (7 out of 7). Then there were increases for the stock indexes CROBEX, PRAGUE, and WIG, which exhibited 5 integrations out of 7 possible throughout the Stress period. It should be emphasized that in the case of the Slovenian index, this increase is notable since it went towards total segmentation during the tranquil time and gets integrated with all of the capital markets under consideration during the stress period. In addition, the BELEX 15 transitioned from total segmentation to integration with two capital markets (in 7 possibilities).

In general, during the Stress period, there was a total of 45 integrations out of 49 possible integrations. These findings are validated by the authors [Horta, Dias, Revez, Heliodoro, et al. \(2022\)](#), [Horta, Dias, Revez, and Alexandre \(2022\)](#), [Teixeira, Dias, Pardal and Horta \(2022\)](#), [Teixeira, Dias, Pardal and Styles \(2022\)](#) who show that levels of integration increase significantly during times of stress in capital markets.

Table 7 shows the results of the unconditional correlations applied to the stock market indexes of Austria (ATX), Hungary (BUX), Croatia (CROBEX), Serbia (BELEX 15), Russia (IMOEX), Czech Republic (Prague SE PX), Slovenia (SBI TOP) and Poland (WIG), for the period from September 19th, 2017, to December 31st, 2019.

From the results obtained, we infer 24 significant correlation coefficients (out of 28 possibilities), the exceptions being market pairs CROBEX - ATX, WIG - BELEX 15, WIG - BUX and WIG - CROBEX, an indication that these may represent diversification opportunities.

Table 7. Unconditional correlation coefficients, applied to the 8 European capital markets, in the Tranquil period

	ATX	BELEX 15	BUX	CROBEX	IMOEX	PRAGUE	SBI TOP	WIG
ATX								
BELEX 15	0.227385***							
BUX	-0.420853***	0.185109***						
CROBEX	0.009039	0.516695***	0.486326***					
IMOEX	-0.603324***	0.207391***	0.673608***	0.591503***				
PRAGUE PX	0.768838***	0.272117***	-0.206536***	0.011392***	-0.242880***			
SBI TOP	-0.196483***	0.071103***	0.282157***	0.454366***	0.657100**	0.084644**		
WIG	0.557287***	-0.020697	-0.004289	-0.061504	-0.527790***	0.292277***	-0.466198***	

Note: ***, **, * indicate significant results at 1%, 5% and 10%, respectively.

Source: Own elaboration

Table 8 presents the findings of the unconditional correlations for the Stress period. We notice a significant increase in the correlation coefficients, i.e., 28 pairings, primarily with t-statistic values more than 0.66, indicating the influence of the 2020 and 2022 events on these regional markets.

Table 8. Unconditional correlation coefficients, applied to the 8 European capital markets, in the Stress period

	ATX	BELEX 15	BUX	CROBEX	IMOEX	PRAGUE	SBI TOP	WIG
ATX								
BELEX 15	0.777059***							
BUX	0.895988***	0.588847***						
CROBEX	0.887853***	0.882966***	0.765396***					
IMOEX	0.622387***	0.118227***	0.732815***	0.280026***				
PRAGUE	0.914973***	0.884367***	0.773010***	0.931114***	0.341658***			
SBI TOP	0.901590***	0.808362***	0.829443***	0.913333***	0.394006***	0.948931***		
WIG	0.896326***	0.530013***	0.934582***	0.745809***	0.767204***	0.778063***	0.823572***	

Note: ***, **, * indicate significant results at 1%, 5% and 10%, respectively.

Source: Own elaboration

Table 9 exhibits the findings of [Forbes and Rigobon's \(2002\)](#) t-test applied to Austria (ATX), Hungary (BUX), Croatia (CROBEX), Serbia (BELEX 15), Russia (IMOEX), Czech Republic (Prague SE PX), Slovenia (SBI TOP), and Poland's capital markets (WIG).

Table 9. Results of the contagion effect between the Tranquil / Crisis sub-periods

Markets	t-Statistic	Results	Markets	t-Statistic	Results
ATX - BELEX	4.376337***	Contagion	IMOEX - ATX	1.894627**	Contagion
ATX - BUX	3.6353***	Contagion	IMOEX - BELEX	1.926814**	Contagion
ATX - CROBEX	3.253258***	Contagion	IMOEX - BUX	1.755059*	Contagion
ATX - IMOEX	2.982893***	Contagion	IMOEX - CROBEX	1.107605	No Contagion
ATX - PRAGUE	3.846239***	Contagion	IMOEX - PRAGUE	1.873849**	Contagion
ATX - SBI TOP	3.730509***	Contagion	IMOEX - SBI TOP	1.847399**	Contagion
ATX - WIG	4.560274***	Contagion	IMOEX - WIG	2.717065***	Contagion
BELEX - ATX	2.594361**	Contagion	PRAGUE - ATX	3.19562***	Contagion
BELEX - BUX	2.558173**	Contagion	PRAGUE - BELEX	3.782337***	Contagion
BELEX - CROBEX	2.050669**	Contagion	PRAGUE - BUX	3.259158***	Contagion
BELEX - IMOEX	2.168363**	Contagion	PRAGUE - CROBEX	2.832829***	Contagion
BELEX - PRAGUE	2.697742***	Contagion	PRAGUE - IMOEX	2.724855***	Contagion
BELEX - SBI TOP	2.64508***	Contagion	PRAGUE - SBI TOP	3.348636***	Contagion
BELEX - WIG	3.4441623***	Contagion	PRAGUE - WIG	4.145284***	Contagion
BUX - ATX	3.310339***	Contagion	SBI TOP - ATX	3.25925625***	Contagion
BUX - BELEX	4.1651***	Contagion	SBI TOP - BELEX	3.9212997***	Contagion
BUX - CROBEX	3.021501***	Contagion	SBI TOP - BUX	3.34133851***	Contagion
BUX - IMOEX	2.801365***	Contagion	SBI TOP - CROBEX	2.92336463***	Contagion
BUX - PRAGUE	6.639161***	Contagion	SBI TOP - IMOEX	2.77694675***	Contagion
BUX - SBI TOP	3.52688***	Contagion	SBI TOP - PRAGUE	3.5258224***	Contagion
BUX - WIG	4.375078***	Contagion	SBI - WIG	4.24104484***	Contagion
CROBEX - ATX	3.087559***	Contagion	WIG - ATX	3.269631***	Contagion
CROBEX - BELEX	3.611854***	Contagion	WIG - BELEX	4.080208***	Contagion
CROBEX - BUX	3.131752***	Contagion	WIG - BUX	3.378543***	Contagion
CROBEX - IMOEX	2.626148***	Contagion	WIG - CROBEX	2.963132***	Contagion
CROBEX - PRAGUE	3.299137***	Contagion	WIG - IMOEX	2.766422***	Contagion
CROBEX - SBI TOP	3.22047***	Contagion	WIG - PRAGUE	3.582403***	Contagion
CROBEX - WIG	4.014772***	Contagion	WIG - SBI TOP	3.474553***	Contagion

Notes: Critical values correspond to a one-tailed significance on the right, 2.7638 (1%), 1.8125 (5%) and 1.3722 (10%). ***, **, * indicate significant results at 1%, 5% and 10%, respectively.

Source: Own elaboration

The results indicate the presence of contagion in 48 of the 49 eligible market pairs, except for the IMOEX-CROBEX market pair. The evidence of contagion may be explained in part by the significant increase in correlations between the capital markets under consideration. These findings have significant consequences for investors and portfolio managers, as they call into question the possibility of portfolio diversification.

5. CONCLUSION

The general conclusion to be retained and supported by the results obtained employing mathematical and econometric models, is that the events of 2020, the global pandemic and the oil price war between Saudi Arabia and Russia, as well as the current war between Russia and Ukraine in 2022, have a significant impact on these regional markets. We discovered that markets integrated throughout the Stress period, but we also confirmed the existence of significant contagion; these findings suggest that investors participating in these markets may face challenges in portfolio diversification and risk mitigation.

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The Challenging Consequences of the Russian-Ukrainian Conflict and a New Transition in Global Trade, Energy Market and Oil Prices

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Abstract: *This paper analyzes and presents how far the challenging consequences of the Russian-Ukrainian conflict have impacted global trade, the energy market and oil prices. The Russian-Ukrainian conflict has affected the world's stability and economy by putting so many new challenges and obstacles to supply chains and industries. Due to the escalations of the conflict, the energy market has known big changes, especially after oil prices that have been rising to approximately \$ 110 per barrel since March 2022.*

In our methodology, we based on data analysis and a review of the previous literature where the research question is: "how far the consequences of the Russian-Ukrainian conflict could introduce a new transition in Global trade, energy market and Oil prices?"

The results show that the conflict caused a big rise in Oil prices to their highest level in 14 years and this has led to high rates of inflation, an economic downturn globally and low access to food and energy in many countries.

The conclusions show that the dependence on energy after the start of the escalation and the instability of imports and exports have boosted a new transition in global trade, the energy market and oil prices.

1. INTRODUCTION

The Russian-Ukrainian conflict has impacted the world's economy and stability by putting so many challenges and obstacles to supply chains and industries. Due to the escalation of the war and constant conflict, the energy market has known big changes, especially after the oil prices have known a rise where precisely the price of crude oil in the global market increased from \$76 to more than \$ 100 per barrel after March 2022 (World Bank, 2022; GEP, 2022) (See figures 1,2,3,5,6).

The sanctions on Russia and the war in Ukraine affected economies at the global level including emerging markets and developing countries by proving economic recession and more inflation, especially in Europe and Central Asia. According to the World Bank, the Ukrainian economy in 2022 and later is expected to recess with at least 45.1%, moreover, Russia's economy has been already in a deep recession with output projected to contract by 11% in 2022 (World Bank, 2022) and until the moment of presenting this paper (Dec 1st, 2022).

The Russian-Ukrainian conflict has had high impacts on the energy market that could spill over to various markets such (as the food market, etc.). The effect of the interaction between energy and food can be described as a telecoupling effect (Liu et al, 2017). The Russian-Ukrainian conflict is a "fossil fuel" conflict (Schiffer et al, 2022).

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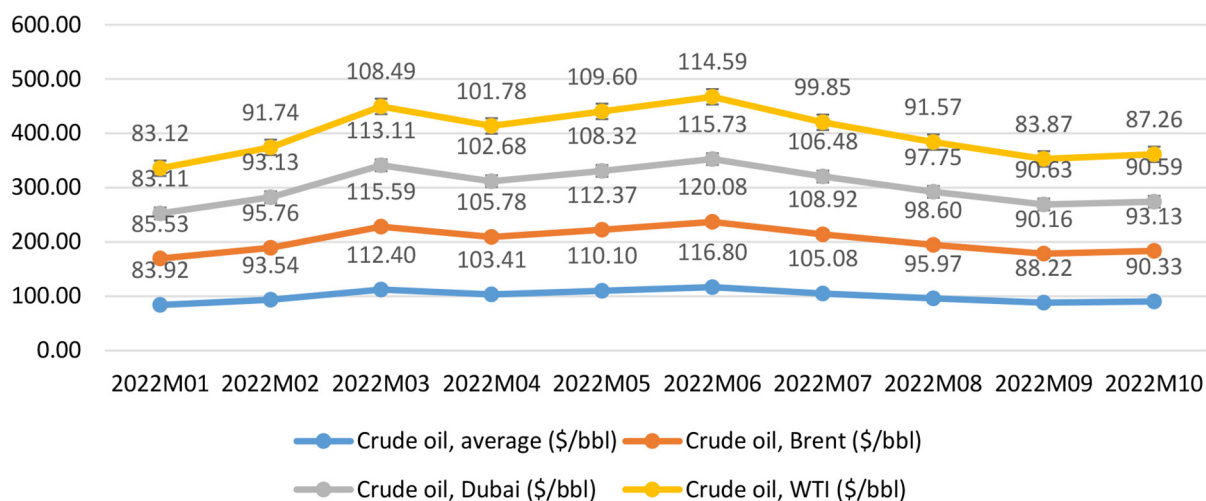


Figure 1. Crude oil monthly prices in the nominal dollar in 2022

Source: Author's contribution, [World commodity price data, Nov 2022 \(Pink Sheet\)](#)

2. METHODOLOGY OF RESEARCH AND RESEARCH QUESTION

In our methodology, we based on data analysis and a review of the previous literature where the research question is “How far the consequences of the Russian-Ukrainian conflict could introduce a new transition in Global trade, energy market and Oil prices?”

3. RUSSIAN-UKRAINIAN CONFLICT AND ITS IMPACT ON THE PETROLEUM INDUSTRY

Since the oil demand is very necessary and considered a priority, the oil industry has faced several challenges after the pandemic and the sudden Russian-Ukrainian conflict. The conflict introduced more economic barriers to poor nations, developing countries and countries that depend more on energy imports, the thing that could impose difficulties to find fast solutions and alternatives to cover their losses since energy is one of the important sectors of the economy. Thus, the fast-changing energy world has applied new structures and rules on the economy, business and global trade.

4. EUROPE, THE WORLD AND THE LINK OF DEPENDENCE ON RUSSIAN HYDROCARBONS

After Europe decided to look for alternatives to Russian energy exports, Russia could find other markets for its products by applying and offering discounts of \$ 15-20 per barrel.

Indeed, it is kind of impossible to predict the future of markets even if the world is going through a high energy demand during the new energy prices and offers.

Moreover, if the EU leaves the Russian oil and gas supplies totally, the EU member states could face an acute economic crisis since the demand for oil and gas is a priority for the major part of them. Besides, commodity prices play an important role in the production and more exactly in the industry sector. On the other hand, the increase in energy prices contributes to high prices of services and goods and leads directly to inflation processes.

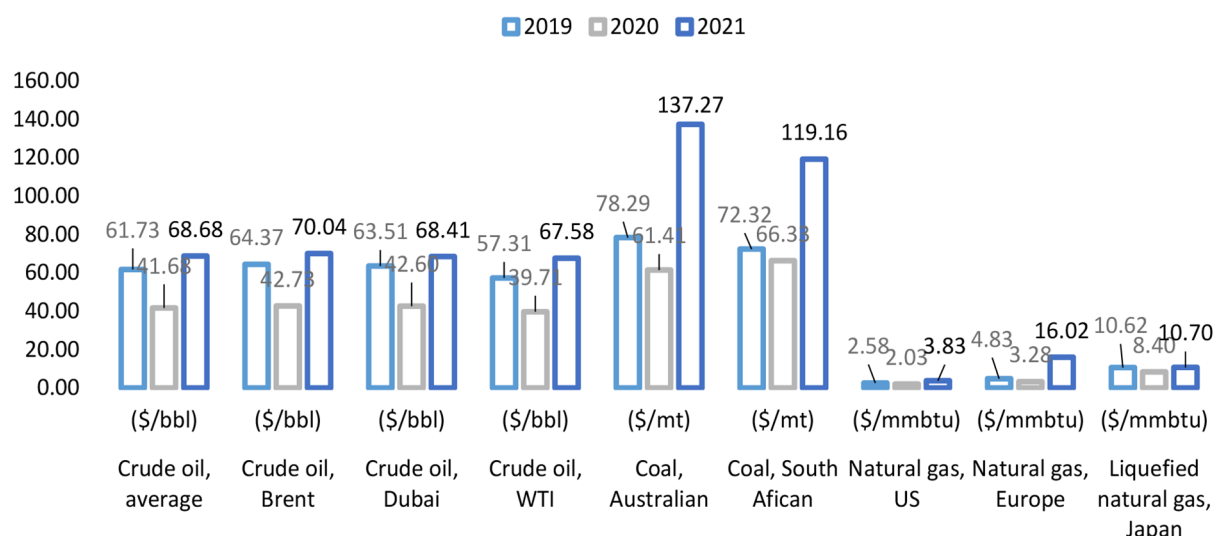


Figure 2. Energy prices in nominal dollar, 2022

Source: Author's contribution, [World commodity price data, Nov 2022 \(Pink Sheet\)](#)

EU countries have been trying to find a degree to which they can agree and manage the fact to cap Russian crude prices, especially before the sanctions that come into effect on Dec. 5 (Lee, BNNBloomberg, 2022).

Some governments started to apply measures to push customers away from the increased prices, inflation and rising energy prices. Indeed, taxes on gasoline and diesel could be more than half paid by the customers at the petrol station or pump. Otherwise, all the costs might be covered by the customers. The new energy transition is not about climate change and sustainability since they are not considered priorities anymore after the start of the Russian-Ukrainian conflict; the new energy transition is towards energy security, demand and balance which are now the major priorities in the agenda (See figures 1, 2, 3, 4).

According to BNNBloomberg by November 2022, the derivation of Russia's crude exports has a focus more on Asia with record volumes heading on tankers to the region's ports.

The switch has become acute as a need after the ban on seaborne imports into Europe which used to be Russia's main export market. Two-thirds of crude loaded onto tankers at Russian ports is now moving towards Asia which is compared to two-fifths before the escalation, the war and conflict by March 2022 (Lee, BNNBloomberg, 2022).

Besides, the change and switch from one market to another have affected the global economy and created more escalation even if the change and increase in oil and commodity prices as explained below is something logical like Euro and dollar. However, it can be less expensive if we compare the price of a barrel of crude oil to a pair of shoes with European or American brands that sell huge amounts of shoes and clothes at the price of more than \$100 for a single piece and product, the same thing for other products and brands in the international trade level.

Europe seems to be thinking again about nuclear and minded coal energies as alternatives with an acceleration in renewable energy investments as substitutes to Russian gas and coal. High oil and gas prices could rise the point and attention to boosting electric and hydrogen vehicles, the thing that is considered to be more expensive for so many countries and could take a lot of

years to be fully accepted or adopted in societies that used to rely on hydrocarbons for vehicles, industrial plants and manufactories.

As Europe is considered the main market of energy for Russia, the decision to cut down on Russian oil and gas affected the European economy and market globally, moreover, the Russian hydrocarbon industry used to be considered the main source of revenue for Russia.

The 2022 Russian-Ukrainian high-intensity conflict strengthened diplomatic relations between Europe and the US applied together 6 rounds of sanctions against Russia in the first half of 2022 (Lambert et al, 2022).

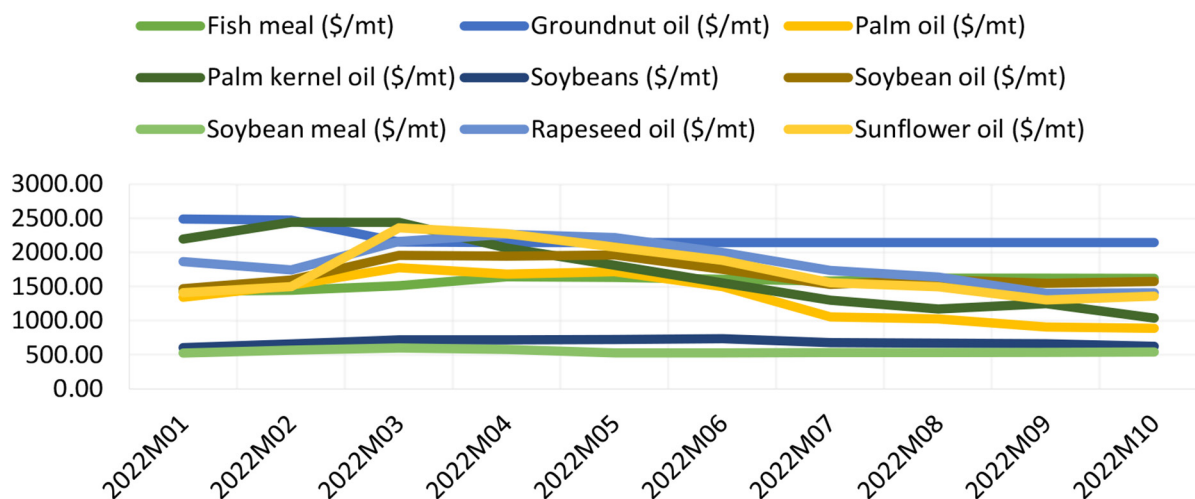


Figure 3. Non-energy commodities (oils) in the nominal dollar in 2022

Source: Author's contribution, World commodity price data, Nov 2022 (Pink Sheet)

5. OIL AS A NECESSARY ENERGY THAT GENERATES THE WORLD AS A GAME CHANGER

Oil is the fuel that moves the world; when talking about the consumption of any product and how its price is set, the well-known law is that of supply and demand. This principle says that the price of the product will be at an equilibrium point where demand is equal to supply, and this equilibrium point is the price that consumers are willing to pay for the product. When it comes to a barrel of oil, one of the most coveted products in the world, the oil demand is important because the so-called black gold generates (35%) of the world's energy.

We need it every day for transportation, to generate electricity in general and above all to keep the industry alive and with it the world economy. The other 65% is generated by coal at 30%, natural gas at 25%, hydroelectric at 5.5%, nuclear energy at 3%, and a minimum percentage for renewable energy at 1.5% (see Figure 4).

The demand for oil increases with economic growth; the more the economy grows and the more oil is needed for the factories to produce, the more hours are worked, and therefore more electricity is needed. In addition to the fact that more is consumed, more fuel is already needed to transport goods, and the exact opposite happens if the economy is bad, an economic crisis almost always means less demand for oil. This happened, for example, in the 2008 crisis and in 2019 the fear of an economic recession, the thing that happened exactly after the start of the

pandemic and the Russian-Ukrainian conflict (Russia's invasion of Ukraine) in 2022. The recession of the economy has more or less slowed down the demand for oil and the countries that consume the most are those with the largest economies.

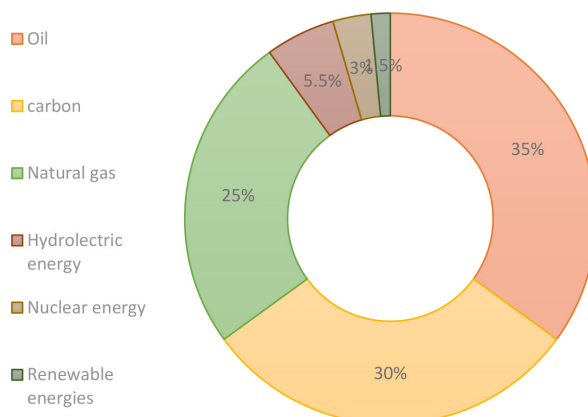


Figure 4. Energies that generate the world's industries in %

Source: Author's contribution, *Society of petroleum engineers, OPEC, 2022.*

The list is headed by the United States and China; the other point that is essential to set a price is the offer. It is not just a question of extracting and selling oil, but of strategically putting it on the market. For this in 1960, five countries founded OPEC, which is the organization of oil-producing countries. Iraq, Iran, Saudi Arabia, Kuwait, Venezuela and then other countries such as Ecuador and Angola were added, today there are a total of 14 countries. OPEC is considered a kind of tap, it opens and closes depending on its interests and fundamentally those of Saudi Arabia, the group's largest oil producer.

Basically, it controls production and decides how many barrels of oil are produced per day in each country that is part of OPEC. For example, when demand falls, OPEC cuts production so that there is less supply and prices remain the same or rise. This is why it has been very controversial. For example, in the 1970s OPEC production cuts caused the price of oil to triple, and what OPEC countries decide has an impact because they control more than 30% of world production, but the other 70% of the world have powerful players: the US, according to the US Energy Information Administration, the largest oil producer has 18% of the market, Russia 11%, China and Canada 5% for each one and Brazil 3%. That's why we may consider the other key factor that influences the oil price of oil. The United States became the largest oil producer in the world in 2018, recording historical extraction records, after implementing techniques such as "Fracking oil" that according to environmentalists generate a high environmental impact. Fracking oil produces 17.8 million barrels of oil per day, which is why it has become a source counterweight to OPEC, that is, the more oil the US produces, the less OPEC produces when trying to control prices in the market.

But on the other side of the scale is Russia, the third largest oil producer in the world behind Saudi Arabia and recent years has also become an ally of OPEC to increase and decrease oil production and thus control its price with the countries involved in OPEC. On the other hand, Russia's participation is also to further increase its influence in the Middle East, where the main OPEC producers are.

China and India are the two countries that consume the most oil in the market; we must take into account how Venezuela and Iran are subject to sanctions and the Middle East is at war and is very volatile, which affects crude oil prices.



Figure 5. Average annual OPEC crude oil price from 1960 to 2022 (in U.S. dollars per barrel)

Source: Adapted from [OPEC STATISTA, 2022](#).

An increase in the price of oil affects life in many ways, primarily the cost of our daily transportation can increase. This is a domino effect - when the price of fuel increases, all products tend to increase in price because it costs more to transport them and that is generally paid by consumers in supermarkets. Although those who live in an oil country could benefit by getting more money from the sale of their oil (see figures 1, 2, 3, 4, 5, 6).

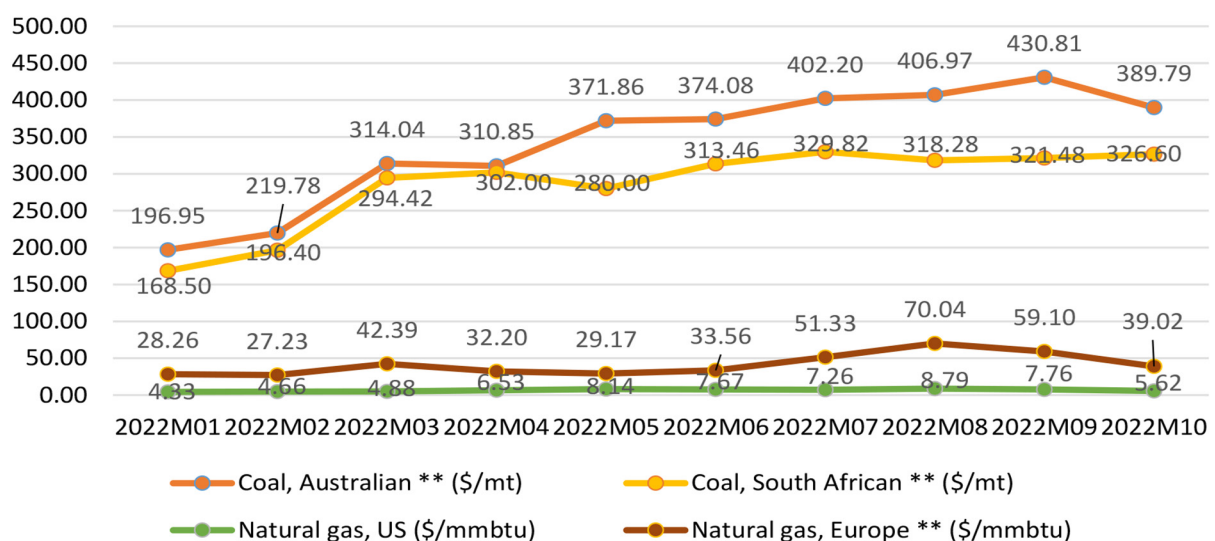


Figure 6. Natural gas and coal prices in the nominal dollar in 2022

Source: Author's contribution, [World commodity price data, Nov 2022 \(Pink Sheet\)](#)

6. RESULTS AND CONCLUSION

The results show that the Russian-Ukrainian conflict caused a big rise in oil prices to their highest level in 14 years, and this has led to high rates of inflation, an economic downturn globally and low access to food and energy in many countries.

The analysis results show that the dependence on energy after the start of the escalation and the instability of imports and exports have boosted a new transition in global trade, the energy market and oil prices.

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How Much Did the Pandemic Consumption Behaviour Contribute to the Rising Inflation?

The North-Western Romanian Households' Perspectives

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Abstract: *The living standards of Europeans have been facing serious challenges starting with the Covid-19 pandemic, and continuing with the Russia-Ukraine war and all its threats. Europe is facing one of its outcomes in the current gas shortage problem, impacting negatively various aspects of the Europeans' lives, such as rising inflation. However, the rising trend of inflation was noticed even before the problems related to the Russian gas supply. The current paper presumes the Covid-19 pandemic's lockdown and the changes in consumption behaviour also have a relevant contribution to the rising inflation; in this respect, the authors used both deductive – by collecting data regarding the national indicators – and inductive methods, as well – by conducting a survey in the Western part of Romania investigating the consumption patterns. The pandemic challenged individuals, institutions, entire systems, countries and regions to adapt to hardship and to create new ways of overcoming the restrictions imposed by the lockdown; although considering the stressful times and situations created by this phenomenon, it also enhanced negative adaptive and coping behaviours. This paper's focus falls on the level and ways of spending during the pandemic, to assess if the rising inflation started with the irrational spending during the pandemic.*

1. INTRODUCTION

As years ago Mr President Ronald Reagan pointed out that “Inflation is as violent as a mugger, as frightening as an armed robber and as deadly as a hit man”, his affirmation is still valid nowadays and even more, strongly felt in the global economy. Today's high inflation rates are due to numerous recent crisis, such as the Covid-19 pandemic, gas shortage, and war; our attention falls on the pandemic's contribution to consumer behaviour changes, and so the rising inflation. Was argued by several academics that to avoid the economic disruptions that could have been caused by the falling demand during the lockdown, the governments injected funds into the economies. Well, besides ensuring an optimal demand level for the existing supply back then, these actions had also negative impacts by increasing the demand too much, which eventually affected the level of inflation. Our concern is to assess how the population in North-Western Romania approached the financial challenges caused by the Covid-19 pandemic and to see if their approaches could be related to the rising inflation.

2. METHODOLOGY

To meet the current paper's aims, the methodological approaches dealt with were primarily related to a brief review of the literature; after introducing the researched subject and the latest

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and most important findings regarding the pandemic effects on inflation, the paper switched our focus on the empirical part, as data collection from the national statistics database. Besides these national statistics, the authors were engaged in research by designing and applying a survey in the North-Western area of Romania. The survey consisted of 18 questions, answered by 131 respondents.

3. THE COVID-19 PANDEMIC AND THE INFLATION'S EVOLUTION

Unpredictable events can cause economic imbalances, just as the Covid-19 pandemic has thrown the economy out of balance and caused changes in consumer behaviours. The limited possibilities of spending, lowered incomes for those who lost their jobs, and also a certain level of prudence, initiated a decline in the demand level, which could have impacted disastrously the global economy. The early months of the pandemic were characterized by significant disparities in the inflation experiences of households. These dramatic changes determined households to anticipate both higher inflation and unemployment in subsequent periods (...) To avoid potential deflation as well as a collapse of financial markets and the broader economy, aggressive monetary and fiscal stimulus programs were implemented. In part, the logic of these programs was to raise inflation expectations and hence stimulate consumer spending (Weber et al., 2022). Several countries chose to stimulate the demand by injecting public funds into the economies, thus keeping production cycles in balance; however, besides the advantages created by these injections, there are disadvantages as well, rising inflation being one of them. For some of those who received governmental aid (i.e. Covid-19 pandemic unemployment benefits), that money was easily earned money, so their spending wasn't so rigorous, determining so a higher demand than usual, and so higher prices.

Another point of view over the pandemic's effects on inflation was highlighted by Banom & Smădu arguing that "the depressing effect of pandemics on aggregate demand (fall of inflation rates) may occur through heightened uncertainty that increases precautionary savings and lowers investment demand (...) Governments worldwide engaged in large-scale stimulus measures to prevent mass layoffs and bankruptcies and avoid costly worker-firm separations. These policies have likely alleviated the adverse economic effects of the pandemic, and can even lead to a rise in inflation if maintained beyond the health crisis" (Bonam & Smădu, 2022).

There were discrepancies also in the way of perceiving inflation: a substantial share of households initially saw the pandemic as inflationary (Candia et al., 2020), while other households, in particular those with a college education, initially expected the pandemic to lead to low inflation or even deflation. Such a view is more closely aligned with that of firms, market participants and professional forecasters, who largely saw the pandemic as a deflationary demand shock (Armantier et al., 2021). Their differences in perception determined different behaviours regarding spending, saving and investment.

The rising inflation affected strongly the European Union (some countries' inflation rates are presented in Table 1). Firstly, a general drop was present in the majority of the analysed countries – except the Czech Republic and Slovakia – and then, by 2021 the inflation rate started an ascending trend for all the presented countries, reaching excessive values in 2022.

Based on these data it could be assumed the prudential consumption behaviour from 2020 was followed by overspendings in 2021 – fulfilling needs and desires which were limited during the

lockdown, besides another perspective over the meaning and value of life in general – and the final values of 2022 also imply the energetic crises caused by Russian gas shortage, which is proved by the monthly values, as presented in Figure 1 – an abrupt increase in the inflation rate is noticeable starting with September 2021 for all the analysed countries.

Table 1. Annual inflation rate (%)

Country	Year			
	2019	2020	2021	2022
EU	1.48	0.75	2.91	8.84
Austria	1.49	1.4	2.77	8.13
Bulgaria	2.45	1.22	2.85	12.72
Czech Republic	2.58	3.28	3.31	14.34
Hungary	3.42	3.38	5.21	13.38
Poland	2.12	3.67	5.21	12.65
Romania	3.9	2.35	4.11	11.5
Slovakia	2.78	2.01	2.82	11.52

Source: Eurostat, 2022

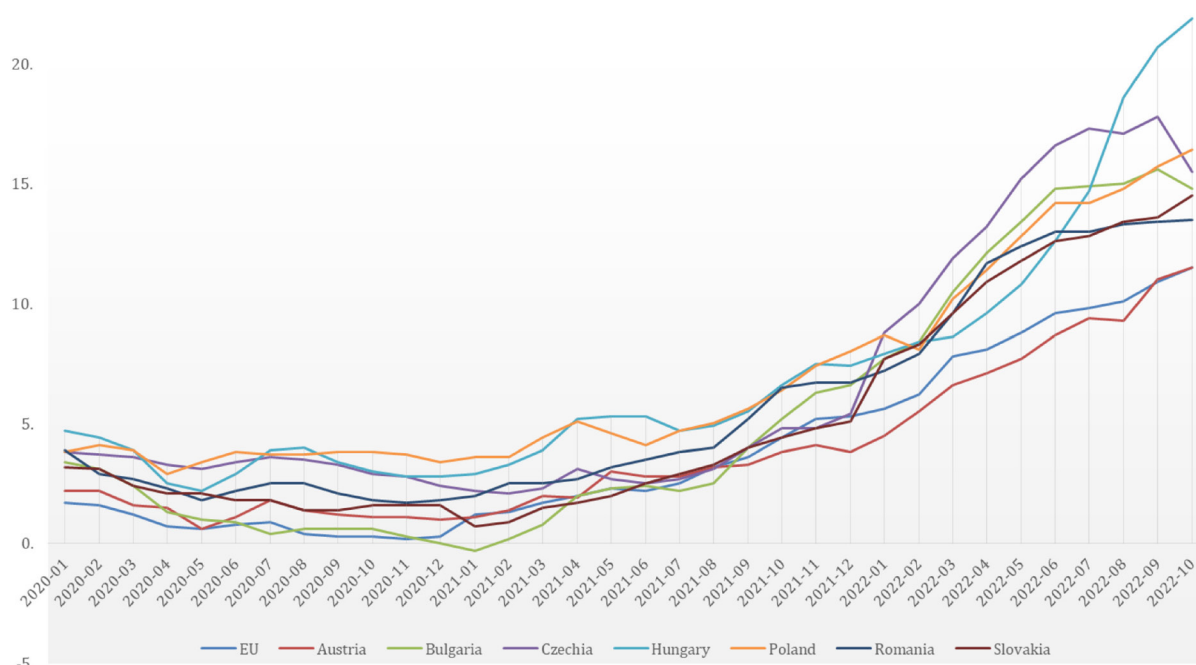


Figure 1. Monthly inflation rates 2020-2022 (%)

Source: Eurostat, 2022

The enormous values of nowadays inflation are determined mostly by the energetic crisis and the Russian – Ukrainian war – these have affected directly the gas supply not only, Ukraine is one of the most important cereal exporters on the global market; but still, the rising trend of the inflation rate started after most of the lockdown restrictions were eliminated.

4. THE PANDEMIC EFFECTS ON ROMANIA'S ECONOMY

Over the last 20 years, the average annual growth of real GDP has been +3.7%, with the last five years before the pandemic recording increases of 4.7% (INSSE, 2020a), well above the average of EU member states in Central and Eastern Europe. The Covid-19 crisis significantly affected Romania's economy, which in 2020 recorded a contraction of -3.9% (interruptions of the supply

chain in the industry, especially the automotive sector; decrease in external demand border closures and internal restrictions).

Considering the inflation, the policy rate has been below inflation, even as inflation has been above the target range for most of 2018-19, amid brisk double-digit wage growth. Following the severe impact that Covid-19 is having on the economy, inflation declined in early 2020 and remained within the target range until the first quarter of 2021 (INSSE, 2020b).

In the post-pandemic period, the National Bank of Romania maintained a relaxed monetary policy to mitigate the recession by reducing the reference interest rate.

5. SURVEY-BASED RESEARCH

The empirical research was extended with a survey conducted in March 2022 in North-Western Romania. The survey is based on the response of 131 people of which 74% of the respondents were women. Considering their age range, 71% are aged between 18-30 years, 17.6% are between 30-50 and 11.5% are aged over 50. Another aspect regarding the analysed sample is that 44% are participants live in urban areas, whereas the others (56%) live in rural areas. Regarding unemployment, according to the answers given, 90.8% weren't unemployed and 9.2% weren't employed during the pandemic. Their living standards are also described by their income level: 42% earn 500-1500 lei (€100 - €300), 28.2% earn 1505-3000 lei (€301 - €500), 17.6% earn 3005-5000 lei (€505 - €1000), 12.2% earn over 5005 lei (€ 1001).

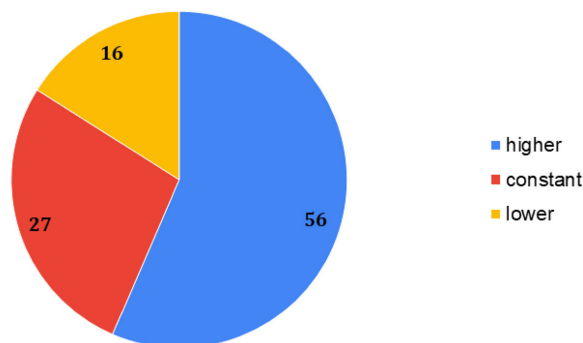


Figure 2. Expenses evolution during Covid-19 pandemic (%)

Source: Own elaboration

When asked about their expenses evolution during the Covid-19 pandemic, 56% noticed that their expenses increased, 27% considered them constant, and only 16% faced decreased expenses (Figure 2).

The respondents noticed mostly the rising of food prices, so it was relevant to ask how did they adapt to this change. Most of them (44%) didn't adapt, they kept their food consumption at least at the same level, so their spending on food increased; an adaption could be observed in 37% of respondents who kept their spending constant, and a prudential behaviour was proved in lowering these expenses by 18% of the respondents (Figure 3).

The pandemic impacted every human being's life, but our concern regards the financial aspects; as presented in Figure 4, the financial impact on the respondents' lives wasn't a strong one - 48% admitting a low or very low impact, whereas only 11% of the respondents faced high consequences.

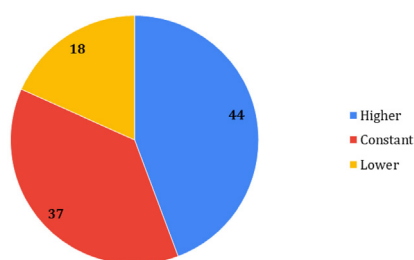


Figure 3.

Spendings on food since the pandemic (%)

Source: Own elaboration

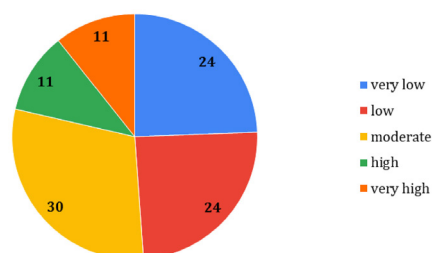


Figure 4.

The pandemic's financial impact (%)

Source: Own elaboration

However, as highlighted previously, the pandemic had alerted and activated prudential behaviour in many, so the savings and investments decisions intrigued us. As far as the pandemic postponed a lot of distractions and consumption allocations, an increase in the savings level is noticed, as 43% of the respondents considered they had saved more money during the lockdown, and also 60% of the respondents decided to invest their money in various ways (Figure 5).

Considering these results, the Covid-19 pandemic alerted and changed consumer behaviour towards a more prudent one; however, this aspect could be debatable as the level of savings could have increased during the lockdown due to restrictions and limited possibilities of spending. Partially this paper could conclude the same about the investments made during the lockdown, although these imply a certain level of risk and knowledge. In terms of spending during the lockdown, we can notice that the people who earned the same as before the pandemic outbreak had no choice but to save and invest their earnings.

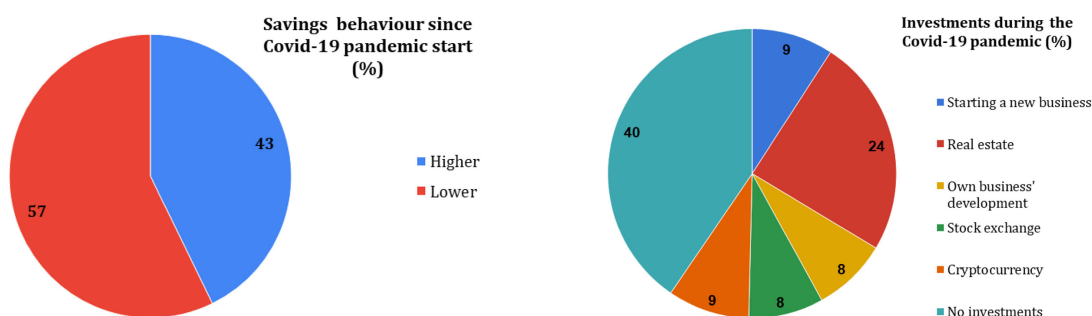


Figure 5. Savings and investments determined by the Covid-19 pandemic (%)

Source: Own elaboration

6. FUTURE RESEARCH DIRECTIONS

The current research paper highlighted the need for deeper analysis – the assessment of the level of government aid how much of it was beneficial, and how much contributed to Romania's rising inflation. To evaluate this view, we will, through another survey, analyse only people who received unemployment benefits.

7. CONCLUSION

The emergence of the Covid-19 pandemic brought the slowdown of all economic activities, and so fears and suspicions invaded the population towards job and income stability. Besides the downturn of the economic system, the potential prudent consumption behaviour alarmed

financial institutions and policymakers, seeing the population prudence as another threat to economic stability. In this regard, stimulus and prevention measure were taken, which alleviated to a certain degree the adverse economic effects of the pandemic.

Considering the survey's sample, the pandemic's impact on households' well-being was moderate, generally increasing the expenses, and lowering the savings; however, investments were made – as a way to protect actual savings – and only 22% of our respondents were admitting a strong negative impact. Even if our survey shows that consumption increased, it also proves a responsible economic behaviour; this aspect determines us to investigate further the rising inflation's causes, one of which could be the financial aid and stimulus provided by the Government – based on the papers evidence we should assess how much aid was needed and beneficial, and how much did more wrong than good.

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Importance of Language in Central Banks' Management of Financial Markets: Creating Trends and New Vocabulary

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Abstract: Language is often considered a living organism that changes with the times. It is a fact that the glossary of business English has grown in interesting ways in the age of day trading. The ever-growing importance of semantics in financial statements or, perhaps even more importantly, central bank statements seems to have coincided with the rise of the internet as the dominant way of information in the financial industry. Specially programmed algorithms scan Reddit boards in search of new trends, information is absorbed constantly, and trades are realized in seconds. In such an environment, officials' statements have become more obtuse, the language more nuanced, and meanings blurred. The authors analyze the way central banks speak to the markets, how that impacts trends in the trading of financial securities, and provide an overview of some of the vocabulary impacted directly or indirectly by their actions that are now widely used by the financial media, institutions and day traders.

1. INTRODUCTION

In the world of finance, communication has always been of vital importance. The reasons are obvious; publicly traded companies must cultivate proper communication with the markets in order to attract investors to invest in their ventures. On the other hand, public institutions and regulatory bodies must clearly lay out the rules the actors in markets abide by as investors shy from uncertainty. Never has this been more important than in today's hyper-informed markets. The ever-growing importance of semantics in financial statements or, perhaps even more importantly, central bank statements seem to have coincided with the rise of the Internet as the dominant way of information in the financial industry and the evolution of the so-called high-frequency trading algorithms whose entire benefits are predicated on their speed of acting on new information. Social networks, especially Twitter, have grown to be just as or even more important than financial media used to be only twenty years ago. Specially programmed algorithms scan Reddit boards in search of new trends and meme stocks in order to front-run potential short-squeezes. Information is absorbed constantly, and trades are realized in seconds. Never before have statements from market participants been as impactful on the markets as they are today due to the sheer speed of the proliferation of information. Individuals inspire millions of dollars to exchange hands in a matter of minutes through 140-character tweets or, even more astonishing, memes. While most of these phenomena are all connected to the bigger picture of today's financial markets and are important parts of it, in this paper, we have decided to focus on a subject that is perhaps given less attention in scientific research and the public discourse than its other parts; the way central banks communicate with the markets and, directly or indirectly, manage them, thus creating new trends as well as new vocabulary that is inevitably tied to them. In our research, we have mostly focused on what central bankers themselves say on this

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subject, which they find of extreme importance, but have also included statements on this subject from the other side of the market, most notably the critics of the way central banks operate in this regard. In the first part, we establish the context of the discussion by laying out the way modern financial markets function, especially focusing on high-frequency trading algorithms and also mentioning the most popular means of communication including Bloomberg terminals and financial Twitter and Reddit. Secondly, we talk about the way central bankers themselves talk about their language and communication with the public, especially focusing on forward guidance, after which we cover some critics, mostly from the retail trading side. Lastly, we take a look at a specific example of central bank communication by focusing on the use of the word *transitory* by central bankers to characterize the rising inflation of 2021 and 2022.

2. THE HFT MARKETS

In order to discuss the way information in the form of central bank statements impacts markets in today's financial system, it is first important to understand the modern investment markets in a technical sense. Many economists, as well as non-economists, still picture Wall Street trading as a crowd of people shouting trades on the floor of the New York Stock Exchange in New York. While the NYSE building still exists and does look like that for the most part, much of the trading volume actually happens in the server rooms next to or below the floor of the NYSE. In fact, as we learn from Shobhit, "during 2009-2010, more than 60% of U.S. trading was attributed to HFT." (Shobhit, 2021)

HFT stands for high-frequency trading, which represents computer-assisted rule-based algorithmic trading which "uses dedicated programs that make automated trading decisions to place orders. AT split large-sized orders and places these split orders at different times and even manages trade orders after their submission." (Shobhit, 2021) The main advantage of HFT is its speed and the ability to process very large trades in a very short amount of time and it is a rising industry in its own right. As we learn from Grand View Research's report, the global high-frequency trading server market size was valued at "USD 387.9 million in 2020 and is expected to register a compound annual growth rate (CAGR) of 3.5% from 2021 to 2028" and it points out that "the need for Ultra-Low Latency (ULL) in the trading ecosystem and the advancements in quantum computing in financial services are expected to drive the market growth over the forecast period." (High-frequency Trading Server Market Size Report, 2021-2028, n.d.) The speed is such an important aspect of this that companies have even resorted to repurposing microwave communication towers to improve the speed at which their computers communicate with the stock exchanges because "microwave technology has gotten way ahead of the competition as it can convey data in almost half the time which is critical in squeezing profit from fleeting and tiny price discrepancies in assets traded globally." (Myers, 2015)

It is important to note that these trading algorithms, while programmed with specific instructions relative to the trading strategies of the company in question, cannot trade anything without the input of information relevant to the securities the company is interested in. As we learn from Donald Keim (Keim, 2015) from the University of Pennsylvania, high-frequency traders "do not just look at order flows and run ahead of them to gain an edge; they also try to get ahead of market-moving news as well." In his article, he mentions a paper titled, "Media-Driven High Frequency Trading: Evidence from News Analytics" by Wharton finance professor Donald Keim, INSEAD banking and finance professor Massimo Massa and INSEAD doctoral student Bastian von Beschwitz. In the paper, as he states, the authors found out that "the use of

lightning-fast news analysis tools, while legal, combined with high-frequency trading, can have a 'significant' impact on stock returns and trading volume beyond the influence of the news content itself.” (Keim, 2015)

It is evident from these findings why the use of language by financial institutions would be very strictly controlled and why words uttered by central bankers are carefully chosen; one can never be sure exactly how the HFT algorithms might compute a speech given by a central bank governor; bullishly or bearishly. This was not always the case, but today it is and numerous statements from financial professionals confirm this, such as the one from trading manager Ming Jia who once told Marketplace: “We analyze Fed speeches like an eighth grader analyzes, like, text messages”, adding that, “every single word matters.” (Nguyen, 2019) This kind of analysis of the language used by central banks is best demonstrated through trading strategies described with new vocabularies such as FOMO³, MOMO⁴, BTD⁵, or TINA⁶.

Traders use many different sources of information as feeds for HFT algorithms: Bloomberg terminal, financial Twitter posters and even presidents of the United States, as well as financial subreddits such as WallStreetBets which became (in)famous in early 2021 due to the “Gamestop short-squeeze”. However, the most important news for the entirety of the market is without a doubt that coming from the Federal Reserve Board, the European Central Bank, and other central banks of the world.

3. CENTRAL BANKS AND COMMUNICATION

In their working paper on how central banks should communicate with the markets and the public in general, Ehrmann and Fratzscher (2005) state right from the start that “central banks have direct control only over a single interest rate, usually the overnight rate, while their success in achieving their mandate – whether the focus is on price stability or economic activity – requires that they are able to influence asset prices and interest rates at all maturities,” (p. 6) and that “effective communication as much as credible policy actions are of fundamental importance for achieving these objectives.” (Ehrmann & Fratzscher, 2005, p. 6) While this paper was written

³ As per Merriam-Webster, FOMO is “fear of missing out: fear of not being included in something (such as an interesting or enjoyable activity) that others are experiencing “. (<https://www.merriam-webster.com/dictionary/FOMO>) In the context of finance, FOMO represents a fear of missing out on a wave of incredible percentage gains in a bull market. While the term has existed before unrelated to finance, it has lately been used almost exclusively in a financial context. It is often used to describe frantic buying by retail traders and warn of possible dangers.

⁴ MOMO represents momentum investing which involves “going long stocks, futures, market exchange traded funds (ETFs), or any financial instrument showing upward-trending prices and short the respective assets with downward-trending prices.” (https://www.investopedia.com/terms/m/momentum_investing.asp)

⁵ BTD is an acronym for “Buy the dip”, which Investopedia describes as “purchasing an asset after it has dropped in price. The belief here is that the new lower price represents a bargain as the “dip” is only a short-term blip and the asset, with time, is likely to bounce back and increase in value.” (<https://www.investopedia.com/terms/b/buy-the-dips.asp>) The concept of “buying the dips” is directly tied to the existence of a so-called “FED put”, meaning the general belief that the Federal Reserve Bank of the United States will always manipulate the financial markets in the case of a serious downturn and that, in the long run, “stocks only go up”.

⁶ There is no alternative,” often abbreviated as “TINA,” is a phrase that was first used by Herbert Spencer and later became a slogan for British Prime Minister Margaret Thatcher in the 1980s, while today, “it is often used by investors to explain a less-than-ideal portfolio allocation, usually of stocks, because other asset classes offer even worse returns. This situation and the subsequent decisions of investors can lead to the “TINA Effect” whereby stocks rise only because investors have no viable alternative.” (<https://www.investopedia.com/terms/t/tina-there-no-alternative.asp>)

17 years ago, this notion only grew in acceptance among central bankers all over the world since and, with the rise of the Internet, has evolved in the way it is applied in communicating with the public. This is evident from the number of speeches given by central bankers at various conferences. For example, between September 26 and October 7 of 2022, members of the Federal Reserve Open Market Committee held 31 speeches. Not all of them were directly tied to the monetary policy of the Federal Reserve, but many of them commented on current and/or future monetary policy and continue to do so regularly.

Of course, while the sheer number of speeches is an indication of how important communication is to central bankers, it tells us little about how they actually speak, which may be even more important than how often they speak. Particularities of language matter as they affect market behavior in perhaps unexpected ways. For example, [Chen \(2013\)](#) in his research on the effect of language on economic behavior states that his findings “are largely consistent with the hypothesis that languages with obligatory future-time reference lead their speakers to engage in less future-oriented behavior.” (p. 31) Galardo and Guerrieri from the Central Bank of Italy have undertaken fascinating research on the frequency of use of future tense verbs in monetary policy statements and the results “from the econometric analysis have shown that using a future tense that is perceived by the public as a commitment in pursuing a particular monetary policy stance is indeed effective in shaping future short-term interest rates expectations.” ([Galardo & Guerrieri, 2017, p. 34](#))

This use of future tense is directly connected to a method central banks use in their communication with the public; forward guidance or, put differently, management of expectations. Forward guidance, in the words of the US Federal Reserve, is “a tool that central banks use to provide communication to the public about the likely future course of monetary policy.” ([Federal Reserve System, n.d.](#)) We consider it important to note the use of the word “likely” in that statement from the US FED website due to how it adds ambiguousness, but more on that a bit later. Seeing as how financial markets are considered “forward-looking” and that, as we have already established earlier in the paper, investing today time is of the essence more than ever before, it is no wonder that “when central banks provide forward guidance, individuals and businesses will use this information in making decisions about spending and investments” ([Federal Reserve System, n.d.](#)) as quickly as possible.

It is understandable and an established fact that investors do not like uncertainty, which is why central banks have a vested interest in calming the markets in times of distress, especially by providing rather optimistic projections about the future. While no central bank states this clearly in their mission, it is obvious that doing anything else would make their job of managing markets and expectations harder and would essentially be counter-productive. With this being rather obvious, it is no wonder that some commentators raise a controversial question; do central bankers always say the truth in order to calm the markets? As the example of “transitory” inflation of 2021 shows, the answer is rather complicated.

4. THE CASE OF TRANSITORY INFLATION OF 2021

Some critics of central banks and their officials attack them very strongly, sometimes even accusing them of outright lying to the public in order to keep the markets calm and orderly. Anatole Kaletsky famously said in an interview for CNBC that: “Central bankers have a license to lie.” ([CNBC, 2015](#)) This, as we learn from George DeMartino, is not an unusual stance when it comes to how people view economists in general. In his paper, titled “Should Economists Tell

the Truth? Prosocial lying, Paternalism, and the Ben Bernanke Problem” (DeMartino, 2020), he comments on Dani Rodrik’s statement that there is a large “disconnect between the seminar room, where economists acknowledge and engage openly with the limitations to and nuances of their science, and public forums, where they oversimplify what their models tell them and exaggerate their capacities so as to alter public perceptions” (p. 3) by saying that the economic profession “lied to the public so as to promote the success of a regime that the profession believed would generate substantial harm to large numbers of people.” (DeMartino, 2020, p. 3) While this might not be unexpected behavior for a private company, it would surely be for a public institution, especially one responsible for maintaining the entire financial system of a country. To answer the question of whether central bankers lie to the public is both simple and complicated. The simple answer is no, they do not (for the most part), but the complicated part, as we will see in the following example, lies in the ambiguity of their communication with the public. The example we have chosen is a rather recent one that concerns the prevalent characterization of rising rates of inflation that started in 2021 in the west as *transitory* by all of the most influential central banks in the west: the FED, CBOE, ECB, and even the Croatian National Bank.

When price inflation started to rise in 2021, Jerome Powell of the Fed famously stated it was “transitory” and that therefore it was not necessary for central banks to act quickly to stop it, and he was later followed by most western central bankers. Merriam-Webster defines the meaning of the word *transitory* as follows: “Of brief duration, tending to pass away”. (Merriam-Webster, 2022) However, it is not exactly clear what one would mean by saying elevated inflation is transitory. Would it mean the elevated prices would come back down after a short period? If so, how long is this *transitory* period of elevated prices expected to last? Is 2 years considered short or long? Much confusion arose in financial circles regarding this characterization of inflation. As Rachel Siegel points out in her article for the Washington Post, FED officials “have worked to clarify that their meaning behind ‘transitory’ inflation is quite different from the public’s.” (Siegel, 2021) Indeed, as DeCambre reports, Powell later on explained that their intention behind using the word “transitory” was to convey their stance that heightened rates of inflation will come down in a relatively short period, but that it doesn’t mean current prices will decline, which would imply deflation, but rather that future inflation will slow back down to 2 or 3 percent:

The concept of “transitory” is really this: It is that the increases will happen. We’re not saying they will reverse. That’s not what “transitory” means. It means that the increases in prices will happen, so there will be inflation but that the process of inflation will stop so that—so that there won’t be further—when, when we think of inflation, we really think of inflation going up year upon year upon year upon year. That’s inflation. (DeCambre, 2021)

Finally, Jerome Powell in testimony in front of the Senate Banking Committee, declared it “high time to retire the word “transitory,” which has become a vexation for the U.S. central banker and an inscrutable piece of Jabberwocky to those watching inflation touch a roughly three-decade high.” (DeCambre, 2021)

In our opinion, it cannot be outright said that central banks either lied or even made a mistake by stating that inflation is transitory, simply due to the fact that the meaning is so ambiguous that the standards needed to determine it does not exist. It may very well have been a mistake from a PR perspective, meaning that it opened the Fed to some criticism from the financial world, but in the end, it did accomplish one important thing; it soothed the markets at an uncertain time which, can be said, is one of the most important objectives of central bank communication with the markets in general.

5. CONCLUSION

The subject of this paper is extremely wide and can be approached from multiple different angles, but from the perspective of management, it is obvious that the main function of central bank communication with the markets is to ensure their orderly functioning, reduce panic, and maintain at least a somewhat positive outlook for the future. Aside from setting interest rates, communication with the markets is a central bank's most important tool. As we have demonstrated in this paper, the language used in this process is of extreme importance, not only in the types of verbs used in statements, or simple semantics but also tone and ambiguity. As the example of transitory inflation shows, the use of a carefully selected word can shift the conversation entirely and at the same time calm the markets regardless of whether the statement in question turns out to be a correct view of the markets at a later date. In our view, a central bank cannot and should not be expected to announce forthrightly that it expects a severe economic downturn even when it does, as that would surely cause the downturn to be even worse and come even sooner. If that is so, then central banks must be ambiguous. The fact that central bankers are constantly trying to reach out more to regular citizens also forces them to use less complicated terminology in their communications in order to be able to successfully communicate with the wider public. All of this has an effect on the language they use in communication and subsequently changes the language used in the rest of the markets as investors conform with the discourse set by the banks. This paper only scratches the surface of this subject, but we hope to bring more attention to the question of central bank communication with the public in order to encourage more in-depth research as we hold this subject's importance warrants it.

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Foreign Direct Investment Inflow in the Context of IFRS Adoption: Evidence from Slovakia

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Current Account of the
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Abstract: *IFRS can be considered a global accounting standard; by accepting it, the country can help increase the transparency of financial statements. Increased transparency will subsequently attract new foreign investors who prefer markets with high-quality information and provide them with the opportunity to assess investments at low costs and low risk. The adoption of IFRS can bring positive macroeconomic effects to countries, from which they can subsequently benefit and improve their overall economy. The article analyzes the impact of the adoption of IFRS on FDI in the Slovak Republic for the period from 1995 to 2020 through the correlation coefficients of various related variables. Two research objectives were specified in the article: 1) the adoption of IFRS does not have a significant effect on the inflow of FDI; 2) the adoption of IFRS has a significant impact on the inflow of FDI. The comparison of correlation coefficients showed interesting results in the mentioned context.*

1. INTRODUCTION

As part of the developing uniformity of the financial and accounting sphere, several countries have adopted International Financial Reporting Standards (IFRS) in recent years. The Slovak Republic adopted IFRS in 2005. These standards not only improve the clarity of accounting and reporting in a given country but also support the economic field and have the potential to have a positive effect on foreign direct investment (FDI). Foreign Direct Investment (FDI) represents a direct form of investment by an investor in companies or businesses from another country. Basically, they are an investment by the given investor in a certain selected company. FDI is an investment of at least 10% of a share in a business, for example in the form of buying shares or another business share. The investor acquires significant decision-making power in the selected invested company. From the approach of the system of national accounts, FDI is a component of the balance of payments statistics, specifically the financial account of the balance of payments. FDI is an investment where its essence is a long-term relationship and where an entity based in one country has a permanent interest in an entity based in another country. We can simply characterize FDI as financial transactions in an investment relationship, where the parties involved can be two parties, persons, or nations (the investor and the person invested). It is usual for an investor to take into account the determinants of its environment when placing FDI. The question that many investors may ask, why it is good or why it would be worthwhile to invest in the Slovak Republic (SR), offers several answers. Slovak Investment and Trade Development Agency (SARIO, 2020) list ten interesting reasons why an investor could decide to locate his FDI in the Slovak Republic: location in the center of Europe, security, membership in the Eurozone, qualified workforce, the openness of the economy, developed infrastructure, investment incentives. Part of the business environment in Slovakia is the application of IFRS by several groups of entities. As a framework, IFRS in Slovakia is used by entities of public interest and those that have exceeded the size criteria.

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2. LITERATURE REVIEW

Since the beginning of the nineties, researchers have been studying the impact of IFRS adoption on the economic growth of companies and countries. The results of studies from that period were ambiguous (Zaidi & Huerta, 2014). Gordon et al. (2012) assessed the impact of the adoption of IFRS on the total inflow of FDI into the country and at the same time determined whether this impact differs according to the country with a developing or developed economy. The authors analyzed 124 countries of the world with the finding that the adoption of IFRS has a higher impact on the inflow of FDI in developing countries than in developed economies (p. 393). Nejad et al. (2018) observed the relationship between IFRS adoption and FDI inflows in ASEAN (South East Asian Nations) countries. They found that the levels of FDI inflows increased significantly after the adoption of IFRS in these countries, also that the countries' Gross domestic product (GDP) is positively correlated with FDI inflows (p. 318, 323). These authors also found a positive relationship between IFRS adoption, FDI inflow, openness of the economy and education of the population (p. 319). Gu and Prah (2020) conducted research between FDI inflows, IFRS adoption, GDP growth, openness of the economy, perceptions of trust in the country's compliance agents, and political instability. The result of the research carried out in 12 African countries pointed to the interaction between FDI, IFRS adoption, and the perception of confidence in compliance with the rules in the country (p. 27). The variable "political instability" proved to have an inhibit effect on the inflow of FDI (p. 28). Research on the impact of IFRS adoption on FDI was carried out by Lungu et al. (2017). In the model, they set the dependent variable FDI, and independent variables such as: GDP, IFRS adoption, economic freedom, investment freedom, credit interest rate, exchange rate, financial freedom, political stability, tertiary education, and EU membership. The analysis sample was composed of 26 developing countries of Central and Eastern Europe as well as EU member states. The authors found the fact that countries that accepted IFRS are more likely to benefit from a higher increase in FDI than those countries that ultimately did not adopt IFRS (p. 15). The results characterized a higher increase in FDI inflows after the adoption of IFRS in the case of non-EU countries compared to EU countries. Non-EU countries benefit greatly from the adoption of IFRS through listed and unlisted companies. Conversely, the impact of IFRS adoption is not significant for EU countries when considering IFRS adoption by listed firms (p. 19). Efobi and Nnadi (2015) investigated the connection between foreign aid, IFRS adoption and FDI. Their research aimed to determine to what extent the adoption of IFRS can attract FDI in the presence of foreign aid. This foreign aid is a form of foreign finance that can directly compete or complement FDI. Foreign aid consists of financial flows, technical assistance and commodities that support welfare and economic development and is a significant source of foreign capital inflows. Using the example of 92 countries, they pointed to the fact that IFRS adoption increases FDI, but with the conditional acceptance of foreign aid (p. 16). Zaidi and Huerta (2014) examined IFRS adoption and enforcement as antecedents of economic growth. They hypothesized that there is a relationship between IFRS adoption and economic growth in a country. They took into account the so-called Level of Enforcement defined by Kaufmann et al., (2008, p. 7) as a set of measures for compliance with social and property standards. At the same time, they were based on the assumption that IFRS provides a more unified framework for reporting financial statements than the previous International Accounting Standards (IAS). In addition to the level of enforcement, they used variables such as: IFRS adoption, level of corruption, level of education, FDI, level of economic development of the country, political stability, and EU membership. Based two-staged least regression analysis, they confirmed the hypothesis on a sample of 51 countries that require IFRS for listed companies, thereby confirming the positive impact of IFRS adoption on the country's economic growth (p. 21).

3. METHODOLOGY AND DATA

The research aims to determine the strength (tightness) of the relationship between two quantities. The standardized measure of mutual linear dependence between the values of two variables is the correlation coefficient. The basic method in the article is correlation analysis to determine the strength of the relationship between variables. Data tightness was measured by Pearson's correlation coefficient. The data of the variables were obtained from the websites of the National Bank of Slovakia and the Statistical Office of the Slovak Republic, for the years 1995 – 2020. The variables used in the analysis were: FDI, IFRS dummies (0 = non-adoption, 1 = adoption), GDP, export, import, average nominal wage, prime interest rate, and current account balance of payments.

Figure 1 shows the development of FDI inflows to the Slovak Republic in the years 1995 - 2020. There was a constant inflow of FDI until 2003. After a decline in FDI in 2004, there was renewed growth in 2005. In 2005, the Slovak Republic adopted IFRS for selected entities. The development of FDI inflow changed in the following years, when in 2015 FDI recorded a decrease. The development since the mentioned year already shows a slight increase.

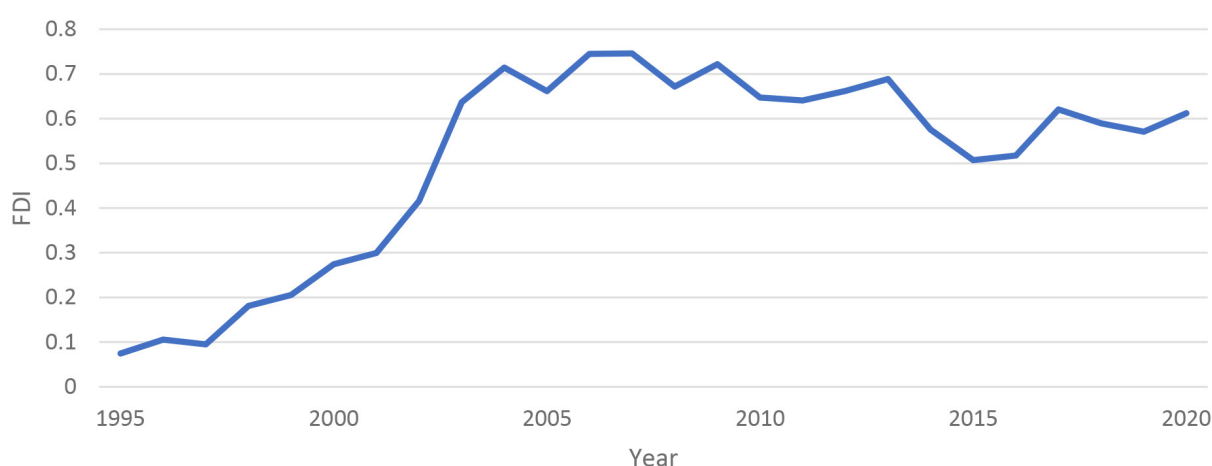


Figure 1. Development of FDI in Slovakia during the years 1995-2020

Source: Own elaboration based on [National Bank of Slovakia, 2022](#)

4. RESULTS

The research questions were whether IFRS adoption has no significant effect on the FDI inflow, or whether IFRS adoption has a significant impact on the FDI inflow. The research was carried out through correlation analysis using the Pearson correlation coefficient. The variables of the model used were FDI, IFRS dummy variable, GDP, Export, Import, Average nominal wage, Prime interest rate, and Balance of payments current account, for the years 1995 - 2020. The results of correlations are arranged in the correlation Table no. 1. The most watched dependency is the relationship between IFRS and FDI. This showed a strong (significant) dependence of 0,7528. The relationships between FDI and GDP (0,6728); FDI and Export (0,6321); and FDI and Import (0,6330) demonstrated high dependence. A strong dependence was demonstrated by the variables IFRS and GDP (0,8895); IFRS and Export (0,8702); and IFRS and Import (0,8726). A very tight dependence was shown by the variables GDP and Export (0,9917); GDP and Import (0,9931); and Export and Import (0,9990). This very close mutual dependence between the variables Export and Import can be excluded from the analysis due to mutual influence. The dependence between the Prime interest rate and other variables is very low (from

0,0247 to 0,3297). High negative dependence is shown by the variable Average nominal wage concerning other variables. This means that the growing development of average nominal wages is negatively correlated with other variables. The variable Balance of payments current account has low negative to no dependence concerning other variables.

Table 1. Correlation analysis table

	FDI	IFRS Dummy	GDP	Export	Import	Average nominal wage	Prime interest rate	Balance of payments current account
FDI	1							
IFRS Dummy	0,7528	1						
GDP	0,6728	0,8895	1					
Export	0,6321	0,8702	0,9917	1				
Import	0,6330	0,8726	0,9931	0,9990	1			
Average nominal wage	-0,6394	-0,6875	-0,7411	-0,7099	-0,6971	1		
Prime interest rate	0,0247	0,2311	0,2812	0,3268	0,3297	-0,2327	1	
Balance of payments CA	-0,3335	-0,2287	-0,0140	0,0361	0,0031	-0,1462	-0,0326	1

Source: Own calculation

The high value of the correlation coefficient of 0,7528 answers the question of whether or not there is a dependency between the IFRS and FDI variables. The significant dependence between the variables IFRS and GDP, IFRS and Export, IFRS and Import is also interesting.

5. FUTURE RESEARCH DIRECTIONS

Strong dependencies between the variables IFRS and GDP, IFRS and Export, and IFRS and Import, give impulses for possible future research directions. It is an interesting phenomenon; the growing development of average nominal wages is negatively correlated with other variables. Also, the analyzed correlation relationship could be investigated in the future, from the point of view of FDI inflow and inflation, unemployment, economic sentiment indicator, and membership of the country in the European Union.

6. CONCLUSION

The purpose of the article Foreign direct investment inflow in the context of IFRS adoption: evidence from Slovakia was to find out, based on established research questions, whether IFRS adoption has or does not have a significant effect on FDI inflow. Efobi and Nnadi (2015), Gordon et al. (2012), Nejad et al. (2018), and Lungu et al. (2017), dealt with the researched area of the impact of IFRS on FDI in different countries. Gu and Prah (2020), and Zaidi and Huerta (2014) contributed by expanding the research on the impact of IFRS adoption on FDI and GDP growth. In principle, the authors confirmed the positive impact of IFRS adoption on FDI inflow, respectively on GDP growth. In this article, additional variables were used to analyze the impact of IFRS adoption on FDI inflow, such as: GDP, Export, Import, Average nominal wage, Prime interest rate, and Balance of payments current account. From the analysis of correlation coefficients, it was found that IFRS and FDI have a strong correlation. The research question was confirmed in the sense that IFRS adoption has a positive effect on FDI inflow. It can be concluded that the adoption of IFRS increases the credibility of financial statements and thus contributes to increased FDI inflow.

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The Impact of Business Support Institutions on the Development of the SME Sector

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Abstract: *The aim of this paper is to critically review and map the network of business support institutions in Croatia and their impact on the development of the small and medium-sized enterprises (SME) sector. There are many research findings in the literature that link the development of the SME sector to the level of institutional development, but rarely articles that link business support institutions to the improvement of the business ecosystem (reduction of barriers). Through in-depth interviews with the heads of business support institutions, this paper aims to explore the impact of business support institutions on reducing barriers that hinder the establishment and development of SMEs. The results show that business support institutions do not have enough resources (time, money, knowledge, etc.) to provide the necessary assistance to SMEs, but also to fulfill other tasks and obligations for which they are responsible. The results of the study can be used for the development of better SME policies, but also for the development of services that better meet the needs of SMEs.*

1. INTRODUCTION

Business support institutions (BSIs) are an important component of any enterprise ecosystem. According to Hall and Jones (1999), the business ecosystem includes "institutions and government policies that determine the economic environment in which individuals acquire capabilities and firms accumulate capital and produce products" (p. 84). The role of BSIs in the business ecosystem is to "create a high-quality, user-oriented entrepreneurial environment by implementing programs focused on the development of the SME sector" through the provision of a wide range of services: Business advice, information, workspace, co-working space, infrastructure, more favorable land prices, legal advice, organization of networking events, etc. Armbruster (2006) identifies three reasons for hiring external experts: consulting, problem-solving, and business improvement. BSIs provide both operational and strategic services (Mole, 2016). The use of BSI services leads to an increase in strategic knowledge that provides competitive advantages (Mole, 2016). Fincham (1999) points out that external help, i.e., BSI help, is particularly valued in dynamic environments, in times of increasing turbulence in global markets, and due to rapid changes in information and communication technology (ICT). External help is needed when adapting to change, but also to take advantage of existing opportunities in the market. In any business ecosystem, BSIs help SMEs overcome obstacles that affect their growth and development.

The Croatian government supports the establishment of BSI with financial grants to promote the creation and growth of SMEs. The Croatian network of BSI is growing every year. According to the Unified Register of Entrepreneurial Infrastructure, there were 496 different BSIs in Croatia in 2020.

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Table 1. Business support institutions in Croatia in 2020.

Type of the Business Support Institution	Number
Entrepreneurial zones	293
Development agencies	76
Business incubators	54
Business accelerators	12
Science parks	2
Business or entrepreneurship centers	48
Competencies centers	8

Source: Alpeza et al., 2022

Although the network is growing every year, the results of the Global Entrepreneurship Monitor (GEM) data show that the number of business support institutions is no guarantee of the quality of external assistance. In the study GEM for 2020, Croatia scores the worst among 18 countries in terms of entrepreneurial infrastructure. Entrepreneurial infrastructure in Croatia acts more as a barrier than as a supporting factor (Singer et al., 2017).

To identify the reasons for the poor quality of external assistance provided by BSIs, in-depth interviews were conducted with managers from different BSIs. The data collected helped to look at the problem from a different perspective and also to formulate policy recommendations for effective solutions.

2. THE ROLE OF BUSINESS SUPPORT INSTITUTIONS IN THE DEVELOPMENT OF SMALL AND MEDIUM-SIZED ENTERPRISES

BSI's main role is to provide business advice and support to SMEs in the early stages of their development. According to Bateman (2000), BSIs in Eastern European countries should have been "the main local engine for SME development" (p. 279). Their role is to help develop a business ecosystem that enables SMEs to grow. Cravo and Piza (2016) demonstrated that BSI services have a positive impact on business performance indicators: new jobs, labor productivity, exports, and investment. SMEs have a weak resource base and can benefit greatly from external assistance (Boter & Lundstrom, 2005). Government assistance provided through BSI is important to the success of any SME (Yusuf, 1995). External help can enhance strategic knowledge and improve competitiveness (Bennett & Robson, 2003). Chrisman and McMullan (2004) emphasized that BSIs can help SMEs to overcome information and knowledge gaps, which are particularly prevalent in the early stages of SME development. External advice usually targets specific needs or provides a strategic view of the organizational potential for future development (Ramsden & Bennett, 2005).

The benefits of seeking external help and support are numerous. Data from developed countries (such as the United Kingdom) show that the number of SMEs seeking advice in their early stages of development is steadily increasing, while the number of existing SMEs seeking external help is very low (Mole, 2016). SME owners are generally unaware that external advice and services exist and are unsure of the value that external help can bring (Ramsden & Bennett, 2005). They do not have enough information about the cost and availability of consulting and are therefore reluctant to use it. Obeng and Blundel (2015) identified the most common reasons for not seeking external advice or services. Their research findings showed that SME owners were unaware of services or service providers. SMEs reported a lack of public information about the existence of BSIs and the services they provide.

Government programmes are often standardized and usually divided into packages aimed at supporting specific groups of entrepreneurs (young entrepreneurs, women entrepreneurs, etc.), industries, or sectors. They do not meet the specific needs of SMEs (Boter & Lundstrom, 2005), are too broad in scope, and cannot solve the specific problems of SMEs (Turok & Raco, 2000). All these reasons lead to poor experiences of using external help or advice and to a lack of trust, which hinders the future use of BSI services.

3. THE NETWORK OF BUSINESS SUPPORT INSTITUTIONS IN CROATIA

To increase the use of external professional help, many government agencies have been established (Bennett & Robson, 2003). In Croatia, the government has followed the same idea in creating a large network of business support institutions. BSIs are usually established by the local, regional, or national government, which also provides financial support for their work. One of their main tasks is to implement government programmes created to support SMEs. Business support institutions provide various services to their users, i.e. the SME sector: Business consulting, information, workspace, co-working space, infrastructure, cheaper land prices, legal advice, organization of networking events, etc. For every 8,880 inhabitants, there is one business support institution offering free advice to SMEs. Although BSIs are numerous, they are concentrated in large cities (especially the capital) and more developed regions (districts), while underdeveloped districts such as Lika - Senj have the smallest number of BSIs.

The tasks of each BSI are defined in the Law on Support for Entrepreneurial Infrastructure (Official Gazette 57/18, 41/14, 114/13 and 93/13).

According to the report BOND (2018), the majority of BSI is registered as a limited liability company and has several tasks: Advice on the establishment and management of SMEs, market research, ICT, education, advertising and marketing, publishing, promotion of business cooperation, organization of seminars, presentations and trade fairs, accounting, provision of accommodation services, renting, management of real estate, etc. BSIs are not all the same size. Some of them have no employees, while others have up to 67 employees. Their activities are financed mainly from the state or county budget, but also from EU projects and services sold on the market. The number of their users is also not comparable. Some BSIs have no users of their services, while others have more than 2000 users in their database. According to the report of BOND (2018), most users of their services seek advice on sources of financing (66.13%), preparation of EU projects and project monitoring (56.45%), management of companies (64.52%), preparation of business plans and investment studies (52.42%). Although there is a demand, BSIs cannot provide advice on internalization, quality standards, commercialization of innovations, and legal and tax advice.

BSIs do not research the needs of their users. Only 37,2% of BSIs tried to find out what kind of service their users need.

The results of the survey on the satisfaction of SMEs in Croatia with BSI services are in line with the results of other developing countries. SMEs do not have enough information about BSI and the services they offer (assistance). The price of the service, although only the preparation and monitoring of EU funds and the preparation of business plans are not free of charge, is also one of the reasons for dissatisfaction. SMEs are also looking for sector-specific advice which BSIs do not provide.



Figure 1. Type of advice that business support institutions do not provide and SME owners would like to obtain

Source: BOND report (2018), p. 46.

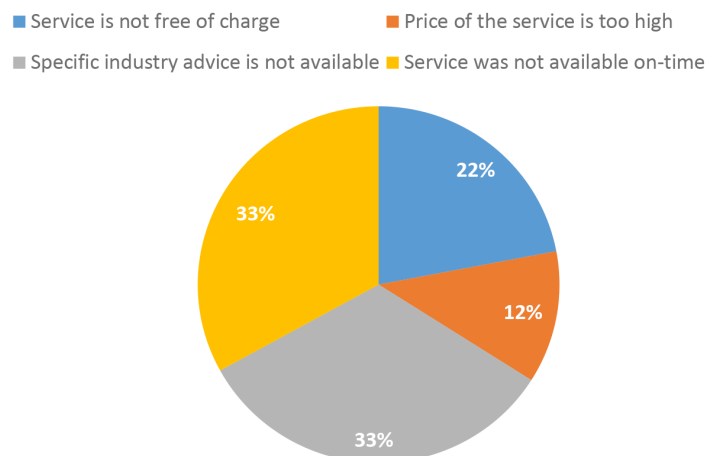


Figure 2. Reasons for dissatisfaction with BSIs services

Source: BOND report (2018), p. 49.

4. METHODOLOGY

In the social sciences, interviews are often used as a qualitative method with the goal of "obtaining a detailed picture of human behaviors and beliefs in the context in which they occur." (Alshenqeti, 2014, p. 39). An interview is a conversation to collect descriptions from the interviewee and his or her interpretations of the phenomena (Kvale, 1996). Since the research method in social sciences determines the success, validity, and reliability of the research (Alshenqeti, 2014), an in-depth interview was a more powerful tool for exploring people's views in greater depth compared to the questionnaire (Cohen et al., 2007; Kvale, 1996). Interviews allow for the exploration of people's behaviors, experiences, and understandings (Brown, 2005). Interviews also allow for linking people's actions to their beliefs.

This paper aims to critically review the impact of BSI on the SME sector in Croatia. BSIs were supposed to create an environment in which SMEs can grow, but the research results of the two main reports on the SME sector in Croatia (GEM and SME Report) show that the obstacles hindering the growth and development of SMEs are equally high and that the innovativeness and competitiveness of Croatian SMEs are low. To identify the needs of the Croatian SME sector, data from the Croatian Agency for SMEs, Innovation and Investment (HAMAG-BICRO) was used. The data was collected in 2018 through focus groups (70 entrepreneurs from different parts of Croatia) and questionnaires completed by 124 BSIs across Croatia. The data was analyzed in the BOND report, which served as a source of secondary data for this study (along with GEM and the SME report).

Primary BSI data, opinions, and attitudes were collected through in-depth interviews with BSI managers. Interviews were conducted via telephone or Zoom platform in September 2022. The sample consisted of managers from business incubators, entrepreneurship centers, development agencies, and county-level economic administrators. Their opinions and attitudes were compared with the needs of SMEs in order to identify the gap that could indicate a lack of activities necessary for the development of the SME sector in Croatia. Since enterprise zone managers were not included in the sample in the BOND report, their views were also not analyzed in this paper.

Table 2. Type of Business support institution in the sample

Type of the Business support institutions	Number of interviewed managers from Business support institutions in Croatia
Business incubators	3
Center for Entrepreneurship	2
Development agencies	2
Administrative department for economy on a county level	1
Competencies centers	2

Source: Author's data

All managers interviewed had more than 15 years of experience working in BSI, advising SME owners, as well as creating various programmes and packages of subsidies and external assistance. Male and female respondents were equally represented in the sample. BSIs in the sample cover the needs of the SME sector on the entire territory of Croatia. They are registered as limited liability companies, local government entities, but also as non-profit organizations.

5. RESULTS

All managers interviewed have experience working with entrepreneurs and in BSIs, they understand the obstacles SMEs face in their development. Although they are managers in their organizations, they do not make independent decisions. Depending on the legal form of their organization, they have to consult with their founders - city or county - when making decisions. Only one BSI in the sample, incorporated as a nonprofit organization, is able to operate independently.

We are able to make independent decisions and organize our BSI according to our plans, but this "freedom" means that we cannot count on constant financial support from the city, county, or government (as other BSIs do).

In developing programs and services for SMEs, BSI managers are guided by the needs of their clients, listen to them, but must also implement programs and provide services that are mandated by the local government or ministry.

Most of the services we provide are determined by the law, but some activities we carry out jointly with local authorities. We try to meet the needs of our users, but we do not have all the required expertise. In addition to the activities we perform for SMEs, there are also activities we perform for our founders.

BSI leaders in the sample carry out a wide range of activities for SMEs: Providing premises, organizing seminars and training, providing advice and information, preparing business plans or investment studies, developing new activities that meet the needs of SMEs, etc. In addition to these regular activities, they also have tasks that are not related to their main activity. The head of a BSI is also responsible for the management of a children's resort on the Adriatic coast, but also for the local cinema. The administrative department designs projects and activities for SMEs, but also designs and implements activities for the local fair.

All BSIs in the sample, except the one organized as a non-profit organization, receive regular subsidies for their activities. Their wages are funded by the municipal or county budget.

Since we have to pay not only for our wages but also for financing activities that cannot be charged to entrepreneurs, especially start-ups, we have to prepare and implement EU projects. We prepare projects for our activities, but also prepare and manage projects for other (mostly public) organizations. This activity slowly became our main activity.

Since local authorities fund the services that most BSIs provide, they are heavily involved in the management of these organizations. Every time there is an election, there is a change in the leadership of the organization. The new leadership brings in new ideas and perspectives, while the previous leader is promoted to advisor to the organization.

Entrepreneurs seek various assistance from BSIs, usually advice on the choice of the legal form of the business, on the preparation of the business plan, on the drafting or analysis of various contracts, but also on the development of business models. None of the BSIs in the sample provide legal advice, although they are aware of the importance of such advice for their users.

We do not have resources (or permission) to employ individuals who could provide such advice. SME owners seek different legal advice, and we are not sure that one person can cover all their needs. Moreover, who takes responsibility for advice that does not meet their expectations?

SME owners seek different types of advice in BSIs. Some of them do not have enough knowledge, but also do not have enough resources to train employees.

In my opinion, SME owners feel that BSIs should provide all kinds of help and support they need.

Owners of SMEs in Croatia seek advice from BSIs, but also from their accountants. On the other side, they do not trust and do not use the services of consultants (Delić & Alpeza, 2017).

SME owners in Croatia needed advice and guidance during the crisis COVID-19, but BSI was not able to design activities that would help SMEs in these chaotic times.

We would really like to help and advise SMEs, but we do not have the knowledge and time to prepare, but also SMEs rarely turn to us and ask for this kind of help.

In the answers of the interviewees, the most important problems are mentioned and explained.

6. CONCLUSION

BSIs in Croatia are predominantly organized as limited liability companies owned by the local government. Their main "funder" is the local government, which regularly provides them with financial support (salaries for employees, subsidies for SMEs, etc.). The management of BSI is under the direct control of the local government, as the organization's CEO must be approved by the local government. The scope of BSI's activities is prescribed by law, and these activities are its core business. Because BSIs are funded by the local government, other activities, sometimes not even related to their core business, must be performed and managed by the BSI. The focus on these activities leaves very little room for the development of new activities that cover all the needs of SMEs in the market.

On the other hand, BSIs, which are independent in their decisions, are constantly in search of financial sources that can cover their salaries and the costs of the activities they carry out. This quest forces them to be more oriented to funders and the preparation of projects, and less oriented to their clients and their needs.

It seems that both types of organizations focus more on internal challenges than on building trust with SMEs and developing activities for them that are tailored to their needs.

Knowledge gaps can be filled through regular education and training of BSI staff, while services and specific advice can be provided through networking and better collaboration between BSIs.

Specialization and collaboration can be a solution to the gap between supply and demand in the management consulting market.

7. FUTURE RESEARCH DIRECTION

Examining the impact of BSI on the development of the SME sector is only a first step toward better understanding the needs of SMEs and the actions that can accelerate their competitiveness and growth.

To better understand how they operate and how large and rich the network of BSIs is, they should be mapped and analyzed in detail.

Since the research method leads and drives the researcher to the results and recommendations, the limitations of this method could be avoided by quantitative methods. Although the respondents remained anonymous, they gave socially accepted answers. Sometimes, when they were unsure of the words to use, they skipped the question or steered the conversation in another direction.

Future research should explore the role of accountants in advising SMEs, as they have closer relationships with SME owners, but also have fewer problems with asymmetric information. Since entrepreneurs tend to learn from each other, the role of SME networking in finding the advice they need is also worth exploring.

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Analysis of the Number of Active Enterprises in Individual Regions of Slovakia in the Period 2014–2019

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Abstract: *The paper aims to analyze the trend in the number of active enterprises in individual regions of Slovakia in the period 2014–2019. Selected characteristics of time series are used to analyze the trend. The contribution method is used to find out which region contributed the most to the total increase in the number of active enterprises.*

The largest increase in the number of active enterprises was in 2017 compared to 2016 when an increase of 5.95% was recorded, which is absolutely 29,496 more active enterprises. The lowest increase was found in 2016 compared to the previous year, namely an increase of 1.86% (9,036 more active enterprises). In 2019 compared to 2014, the number of active enterprises increased by 19.58%. During the entire monitored period, the largest number of active enterprises was in the Bratislava region (124,334 in 2019), the least in the Banská Bystrica region (47,114 in 2014). The number of active enterprises increased the most in 2019 compared to 2014 in the Bratislava region (an increase of 26.84%), the least in the Trenčín region (an increase of 12.80%). In 2014, the Bratislava region had the highest share of the total number of active enterprises (20.56%). Bratislava region contributed the most to the increase in the number of active enterprises in 2019 compared to 2014 by 19.58%, namely 5.52% and Trenčín region the least at 1.29%.

1. INTRODUCTION

The term business demography refers to the database of data created by the National Statistical Office. The need for this data arose as a result of the lack of a register that would provide information on the activity of enterprises.

Currently, business demography provides key information needed for the creation of indicators following the Europe 2020 strategy. It also provides data for a joint Eurostat and OECD project – the EIP (Entrepreneurship Indicators Program) project, which collects international comparable statistics from the field of entrepreneurship (Európsky hospodársky a sociálny výbor, 2022).

Business demography tracks the population of active businesses, the birth of active businesses, the number of surviving active businesses (up to 5 years after their creation) and the death of active businesses. An enterprise as a statistical unit is the smallest combination of legal units, that is, an organizational unit that provides products or services. It performs one or more activities in one or more locations.

Among the set of enterprises, from a demographic point of view, the greatest emphasis is placed on the population of active enterprises. If the company paid social security or insurance for at least one employee in at least one month during the year or submitted a tax return with a non-zero value for the given year, it belongs to the population of active enterprises, otherwise, the company is inactive. The set of active enterprises consists of all enterprises that had sales and/or

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employees in a given year. At the end of 2015, a new methodological guideline came into force in Slovakia. As of 2014, an enterprise that had sales and/or employees and/or investments in the monitored period is also considered an active business in the business demography database (ŠTATISTICKÝ ÚRAD SR, 2016).

The basic indicator of the set of active enterprises is the number (population) of active enterprises in the year (Bolgáč, 2014).

The population of active enterprises, actually the birth, death and survival of enterprises for a certain period form the group of basic indicators of business demography.

2. METHODOLOGY

We will use the contribution method to find out which region contributed the most to the total increase in the number of active enterprises.

2.1. The contribution method

This method is used for the analysis of additive indicators, which are the sum of individual components, while (Hindls et al., 1997):

$$Y_t = \sum_{i=1}^n y_t^i \quad (1)$$

where:

- Y_t is additive indicator,
- y_t^i are individual components.

When applying this method, the following procedure must be followed (Hurbánková & Sivašová, 2018):

1. First, the relative increase of the additive indicator is calculated, which expresses the relative increase of this indicator in the given period compared to the previous period:

$$k_{\Delta t} = \frac{Y_t - Y_{t-1}}{Y_{t-1}} \quad (2)$$

2. Subsequently, we calculate the relative increase of the individual components, which will tell us what relative increase the individual components had:

$$k_{\Delta t}^i = \frac{y_t^i - y_{t-1}^i}{y_{t-1}^i} \quad (3)$$

3. Then we calculate the structural numbers. These tell us what share the individual components have on the additive indicator. These numbers are calculated in the period $t-1$, while we assume that the analogous share of the component in the additive indicator will be preserved during the continuous trend of this indicator:

$$s_{t-1}^i = \frac{y_{t-1}^i}{Y_{t-1}} \quad (4)$$

4. Finally, we calculate how the individual components contributed to the relative increase of the additive indicator. The contribution of each individual component is equal to the

product of its relative increase and the share of this component on the additive indicator in the previous period:

$$k_{\Delta t}^i \cdot s_{t-1}^i \quad (5)$$

The relative increase of the additive indicator is equal to the sum of the contributions of the individual components (Hindls & Hronová, 1997):

$$\sum_{i=1}^n \left(\frac{y_t^i - y_{t-1}^i}{y_{t-1}^i} \right) * \frac{y_{t-1}^i}{Y_{t-1}} = \frac{1}{Y_{t-1}} \sum_{i=1}^n (y_t^i - y_{t-1}^i) = \frac{1}{Y_{t-1}} \left(\sum_{i=1}^n y_t^i - \sum_{i=1}^n y_{t-1}^i \right) = \frac{Y_t - Y_{t-1}}{Y_{t-1}} \quad (6)$$

3. ANALYSIS OF THE TOTAL NUMBER OF ACTIVE ENTERPRISES

In this section, we will analyze the number of active enterprises in Slovakia in the period 2014–2019. First, we will focus on the analysis of the total number of active enterprises, and then we will focus on the analysis of the number of active enterprises in individual regions of Slovakia.

Table 1 shows the number of active enterprises in Slovakia in the period 2014–2019 and the absolute and relative change of the analyzed indicator.

Table 1. The number of active enterprises in Slovakia in the period 2014–2019, the absolute and relative change

Year	2014	2015	2016	2017	2018	2019
The number of active enterprises	476 839	486 337	495 373	524 869	548 271	570 224
Absolute gain	-	9 498	9 036	29 496	23 402	21 953
Growth coefficient	-	1,0199	1,0186	1,0595	1,0446	1,0400
Base index	1,0000	1,0199	1,0389	1,1007	1,1498	1,1958

Source: ŠSTATISTICKÝ ÚRAD SR; Kotlebová et al., 2017.

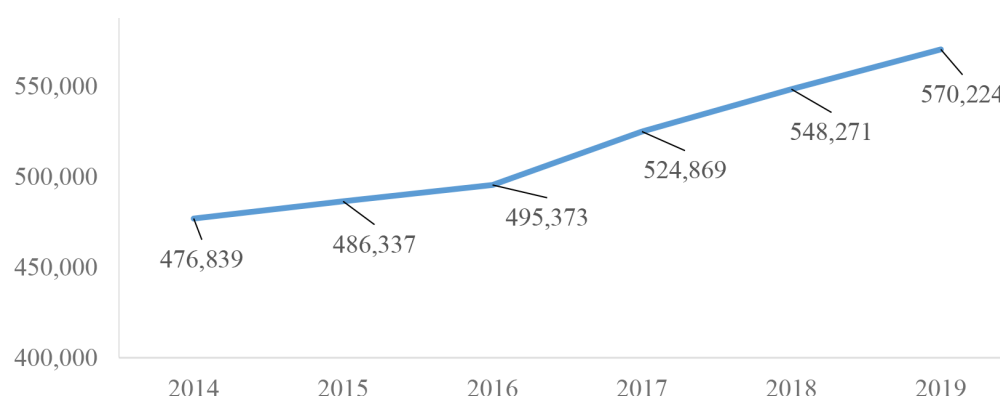


Figure 1. Trend of the number of active enterprises in Slovakia in the period 2014–2019

Source: ŠSTATISTICKÝ ÚRAD SR, own processing in MS Excel based on business demography database

Based on the data in Table 1 on the number of active enterprises in Slovakia in the period 2014–2019 and the calculated characteristics of time series, we can conclude that the most active enterprises were during the monitored period in 2019 (570,224), and on the contrary, the least in 2014 (476,839), while in the period 2014–2019, we noticed a growing trend in the number of active enterprises. Based on the time series characteristics, we found out that the largest increase in the number of active

businesses was in 2017 compared to 2016 when an increase of 5.95% was recorded, which is an absolute increase of 29,496 active enterprises. The lowest increase was found in 2016 compared to the previous year, namely an increase of 1.86% (9,036 more active enterprises). The basic index tells us that in 2019 compared to 2014, the number of active enterprises increased by 19.58%.

The trend of the number of active enterprises in Slovakia can be seen in Figure 1, where we found out that in the period 2014–2019, the number of active enterprises increased. We also noted this in Table 1.

4. ANALYSIS OF THE NUMBER OF ACTIVE ENTERPRISES IN INDIVIDUAL REGIONS OF SLOVAKIA

We can also analyze the number of active enterprises in individual regions of Slovakia. We will focus our attention on the trend of the analyzed indicator of business demography in individual regions.

Table 2. The number of active enterprises in individual regions of Slovakia in the period 2014–2019

The number of active enterprises	2014	2015	2016	2017	2018	2019
Bratislava region (BA)	98 026	105 007	108 075	114 212	119 350	124 334
Trnava region (TT)	47 801	48 557	49 503	52 247	54 199	56 163
Trenčín region (TN)	48 139	47 774	48 293	50 660	52 491	54 303
Nitra region (NR)	57 583	58 829	60 180	63 780	66 997	69 343
Žilina region (ZA)	68 085	67 884	68 775	72 675	75 958	78 861
Banská Bystrica region (BB)	47 114	47 196	47 652	50 653	52 515	53 830
Prešov region (PO)	61 562	61 642	62 779	67 296	71 418	75 652
Košice region (KE)	48 529	49 448	50 116	53 346	55 343	57 738
Total	476 839	486 337	495 373	524 869	548 271	570 224

Source: ŠTATISTICKÝ ÚRAD SR, own processing in MS Excel based on business demography database

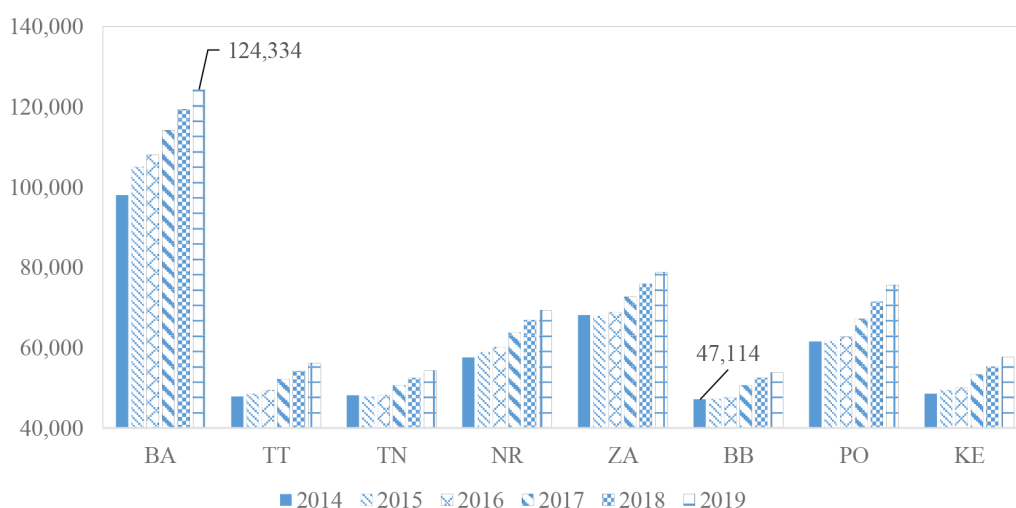


Figure 2. The number of active enterprises in individual regions of the Slovak Republic in the period 2014–2019

Source: ŠTATISTICKÝ ÚRAD SR, own processing in MS Excel based on business demography database

Table 3. Calculation of the contribution method of the number of active enterprises in individual regions of Slovakia in 2014 and 2019

The number of active enterprises	Relative increase	Structural number	Contribution
Bratislava region (BA)	0,2684	0,2056	0,0552
Trnava region (TT)	0,1749	0,1002	0,0175
Trenčín region (TN)	0,1280	0,1010	0,0129
Nitra region (NR)	0,2042	0,1208	0,0247
Žilina region (ZA)	0,1583	0,1428	0,0226
Banská Bystrica region (BB)	0,1425	0,0988	0,0141
Prešov region (PO)	0,2289	0,1291	0,0295
Košice region (KE)	0,1898	0,1018	0,0193
Total	0,1958	1,0000	0,1958

Source: ŠSTATISTICKÝ ÚRAD SR, *Business demography database 2014–2019*, own processing in MS Excel based on business demography database

Table 2 and Figure 2 show the number of active enterprises in individual regions of Slovakia for the period 2014–2019. We can see that the most active enterprises were in the Bratislava region during the entire observed period (the highest number of 124,334 active enterprises was found in 2019), and the least in the Banská Bystrica region (47,114 active enterprises in 2014).

We are also interested in which region contributed the most to the increase in the number of active enterprises in 2019 compared to 2014. We will use the contribution method for the analysis.

Table 3 contains the calculation of the contribution method for the number of active enterprises in individual regions of Slovakia in 2014 and 2019.

5. CONCLUSION

In the paper, we analyzed the trend of the number of active enterprises as one of the indicators of business demography. Analyzed is the period 2014–2019 in individual regions of Slovakia at the NUTS 3 level.

The following conclusions from the performed analyses can be drawn:

- The largest number of active enterprises in Slovakia during the observed period was in 2019 (570,224); on the contrary, the least was in 2014 (476,839).
- The largest increase in the number of active enterprises was in 2017 compared to 2016 when an increase of 5.95% was recorded, which is absolutely 29,496 more active enterprises. The lowest increase was found in 2016 compared to the previous year, namely an increase of 1.86% (9,036 more active enterprises). In 2019 compared to 2014, the number of active enterprises increased by 19.58%.
- During the entire monitored period, the largest number of active enterprises was in the Bratislava region (124,334 in 2019), the least in the Banská Bystrica region (47,114 in 2014).
- The number of active enterprises increased the most in 2019 compared to 2014 in the Bratislava region (an increase of 26.84%), the least in the Trenčín region (an increase of 12.80%). In 2014, the Bratislava region had the highest share of the total number of active enterprises (20.56%). Bratislava region contributed the most to the increase in the number of active enterprises in 2019 compared to 2014 by 5.52% and Trenčín region the least at 1.29%.

Acknowledgment

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Offshore Outsourcing – Models Assessing Destination Countries in the 3rd Decade of 21st Century

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Abstract: *The new decade began with an alarming health crisis (Covid-19), which countries will probably have to deal with for a long time. The war in Ukraine started in February 2022, agitated and raised the alarm regarding geopolitical and economic security for many countries directly or indirectly affected by it. Changing conditions have prompted firms to look at their operating strategies. Recent studies show how important it is to review the determinants of offshore outsourcing in reallocating activities according to the industries. This paper reviews the models for evaluating destination countries and analysing those considering new circumstances.*

1. INTRODUCTION

Global value chains mark an important role in the industrialization process of a developing country, also reducing the costs of the developed ones. Low entry barriers, low capital demand, labour-intensive production, and low levels of skills serve as the primary motivation for developing countries to be immediately involved in low-added value chains (Gereffi & Memedovic, 2003). Global value chains have expanded thanks to trade liberalization and advances in communication and information technology. Foreign companies choose to grow by doing less and outsourcing more. Outsourcing (contracting third parties) is not a phenomenon of the modern economy. Successful theorists such as Coase (1937), Smith (1776), Williamson (1985), and others have proposed outsourcing to reduce costs and stimulate specialization. The outsourcing strategy is profitable for all sizes of firms. Large companies can reduce their costs of contracting a third party in the implementation of non-core activities. Small and medium enterprises have the opportunity to specialize in certain activities and increase their productivity.

Outsourcing dates back as early as the tax collection system on behalf of the Roman Kingdom. Even older professions, such as explorers, traders, or mercenaries, are considered examples of outsourcing (Corbett, 2004). In the 1970s, outsourcing gained increased attention due to the low efficiency of large firms. In the early 80s, many American, European, and Japanese firms built the first offshore factories. Their production was performed in other countries at lower costs and was then exported to the countries of origin (Farrell, 2004). Gradually, they started performing changes in their modus operandi in business by pursuing the strategy of reducing activities performed internally and contracting third parties to carry them out (Kakabadse & Kakabadse, 2005). Although the new century started rapidly through a combination of products and production factors in markets, new situations have once again returned to attention the factors that influence their choice and pick to the attention of the proposed models in the last 2 decades.

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1.1. Lessons from Covid-19 and the Russia-Ukraine War

Over the past few decades, production processes have become increasingly more complex in the world economy. Any finished good now typically embodies added value from multiple countries of origin, often crossing multiple borders en route to its point of consumption, in production arrangements referred to as "global value chains" (Antràs, 2020). Covid-19 is considered a trigger (Barbieri et al. 2020) for many firms in the reframing of their functioning and distribution chains. Recent studies advocate many solutions to supply chain resilience and this should be awareness for the destination countries. How they should develop to respond to the changes in supply chains. Maina & Wambugu (2021) suggest as a strategy supplier diversification, and in the meantime, Valero et al. (2021) find the use of productivity-enhancing technologies as a solution to overpass the Covid restraints. Kumar et al. (2020) suggest developing a flexible and resilient manufacturing system to maintain the economic and social sustainability of the production process. The value chains, still shaken by Covid-19, suffered even greater shock from the war of February 2022. Exactly two years after the outbreak of the pandemic, which limited activity and transport side by side, the war struck a very stimulating factor, until before the pandemic, costs. In an uncontrollable situation of high costs, the firms of developed countries are reconsidering the strategy for going back or reviewing destination countries, while developing countries have strategies and industries that must be kept on their feet for survival.

2. METHODOLOGY

The research on the existing literature had the purpose of determining the aim of this study. The literature review helped identify what has been achieved and what can be achieved by going more in-depth into the knowledge in this field of study. The materials selected during the literature review are very diverse. They include books, online literature, reports, journals, scientific articles, etc. The revised literature is of value not only as a reference source but also as a sound basis for addressing the issues of our study.

3. OFFSHORE OUTSOURCING – THEORETICAL APPROACH

3.1. Offshoring – direct investing versus outsourcing

A value chain is a range of activities involving the design, production, and marketing of a product. Activities in value chains can be carried out in combination within and/or outside the firms of one or more countries. Companies tend to outsource activities for product value chains that require a low level of technology. The opposite is true for industries that require advanced technology (Gereffi & Memedovic, 2003).

Transfer strategies to another country may take the form of direct investments, such as setting up subsidiaries or establishing joint ventures. Another strategy is outsourcing local providers (local firms) to conduct the planned activities (Oshri et al., 2011).

Offshore outsourcing is a strategy for balancing the advantages of domestic costs with the costs of international transactions (Mol et al., 2005). Trade liberalisation and a decline in transaction costs have unlocked a massive supply of labour from developing countries (Geis, 2006). Table 2 presents the strategies that foreign companies can follow along with the motives of transferring offshore one or several activities from value chains.

Table 1. Make-or-buy decisions, according to the motive for transferring abroad

Motive strategy	Search for markets	Search for efficiency	Search for resources	Search for specific assets
Direct investment	✓	-	✓	✓
Outsourcing	✓	✓	✓	-

Source: Authors

The earliest reason for outsourcing activities are the costs they bear to carry them out within companies. Transaction cost theory is used to address internal costs and compare transaction costs in the market. These contracts are not a simple customer-buyer relationship, where the cost is the market price. The execution of orders requires a two-way exchange of information and coordination of work for both companies and outsourced firms. The theory that deals with the evaluation of organisational boundaries and the determination of activities that should or should not be outsourced is the resource-based view theory. Resource Value Base (RVB) theory provides suggestions for contracts that companies can enter into by assessing activities within the business. Outsourcing is the best strategy for low-added-value activities, although today there are no restrictions on outsourced activities. An important aspect is opportunistic behaviour that outsourced firms may exhibit (addressed by agency theory). To avoid such behaviour of providers, one should choose outcome-based contracts. Contracts for the implementation of tailor-made activities (outsourcing) are issues of interest and are the subject of research in any field of economic sciences.

3.2. Offshore outsourcing – Models assessing destination countries in the last two decades

Transferring a business function overseas is directly related to the priorities of the destination countries (Oshri et al., 2015). Important factors include natural reserves, business environment, socio-cultural factors, political force, and legal environment, etc. The successful coordination of these factors indicates the level of readiness to be involved in the world economy and global value chains. In the academic and professional literature, several conceptual schemes (models) have been set up to help assess the advantages enjoyed by countries/regions as potential countries to be destinations of foreign firms in the transfer of activities. In addressing this subject matter, they have in common the following: costs, business environment, workforce availability and specific skills. Economic, technological and geopolitical developments have been accompanied by an expansion of these conceptual schemes. Although the vast majority of research has covered the analysis of foreign direct investment, international production has increased thanks to other forms, including joint ventures and outsourcing (Dunning, 1988). Firms undertake international business to obtain stocks not sufficiently available or too expensive in their countries of origin. They can buy these stocks from another organisation or make direct investments in their acquisition. In either case, they should prioritise where they can best get what they need.

At the beginning of the 21st century, many researchers were encouraged to build models for assessing destination countries as markets for factors and products (Anamali, 2015). According to Kajjumba et al. (2020), the world is already a global village with companies established in different countries to be competitive and grow, but the border closure and other restrictions due to Covid-19 hint at the necessity to summarise the costs/benefits of indoor-outdoor tasks. Antràs (2020) goes further with a darkened perspective of globalisation as a cause of the pandemic.

The Heeks & Nicholson model (2002)

The **Heeks and Nicholson model (2002)**, otherwise known as the *model of successful exports*, is a successful tool to be acquainted with the experience of developing countries. Their paper focuses on the role of government as a catalyst for developing a certain industry. The authors distinguish the market of products and services, stating that products should have a strong internal market to precede them and be related to exports, while services can grow with little connection to the domestic market. According to them, strategies for being competitive in a certain industry are related to experience. Countries that have entered international markets at an early stage can only compete through added value growth, research development, and diversification. Countries with less experience need to be careful about cost strategy.

Table 2. Strategies for boosting exports

	Countries involved Early	Countries involved Late
Strategies of developing countries , to boost the exports of a certain industry.	<p>Switching to higher added value activities (products or services) – on the grounds of competition emerging from new firms and countries offering the same quality at a lower cost.</p> <p>Diversification – into new segments within the market or into new markets.</p> <p>Innovation – launching new products in the same "nodes" of the market</p>	<p>Low-cost – is a very popular version, although the authors do not regard it as very effective for 2 reasons:</p> <ul style="list-style-type: none"> – it is not the key factor in customer requirements – all new competitors may enter the "game" following the same strategy. <p>Market nodes – the study of market gaps, where competition is low, combined with the right factors for production, has proven to be a successful strategy for developing countries.</p>

Source: **Heeks and Nicholson (2002)**

The following are some factors affecting the success of exports in a given industry: industry demand, national vision and strategy, international connections and strategy; industry characteristics, and the infrastructure in place. By the infrastructure in place, the authors encompass the following: cost, human resources (size, knowledge of English, level of qualification); information technology infrastructure; transport infrastructure, and public administration (level of bureaucracy). An important suggestion is to strengthen existing clusters in the industry rather than create new (artificial) clusters, some of which have a history of costly failure.

The Oval model (2003)

The Oval model, as illustrated in Figure 1, evaluates a particular industry and uses it as a conceptual scheme for policies and strategies that countries should undertake to improve their national well-being.

In this model, **Carmel (2003)** included eight factors that, in his view, affect the success of an industry's exports. The government's vision and policies, including tax and financing facilities, lie at the heart of the model. The author has divided the social environment in the country into three important components: a) human resources including national orientation and traditions, size, composition, language skills, and leadership skills, b) salaries and c) quality of life, arguing that talented professionals are inclined to focus on desired locations. The business

environment encompasses the industry and its characteristics, including the effects of clusters, the number of firms, their size, the associations organised by firms in the industry, the level of vision and common brand, and the standards that firms aspire to achieve. The Other two factors are capital (size and resources) and the relationships that arise between individuals, groups, firms, and countries, due to the geographical, cultural, linguistic, or ethnic proximity.

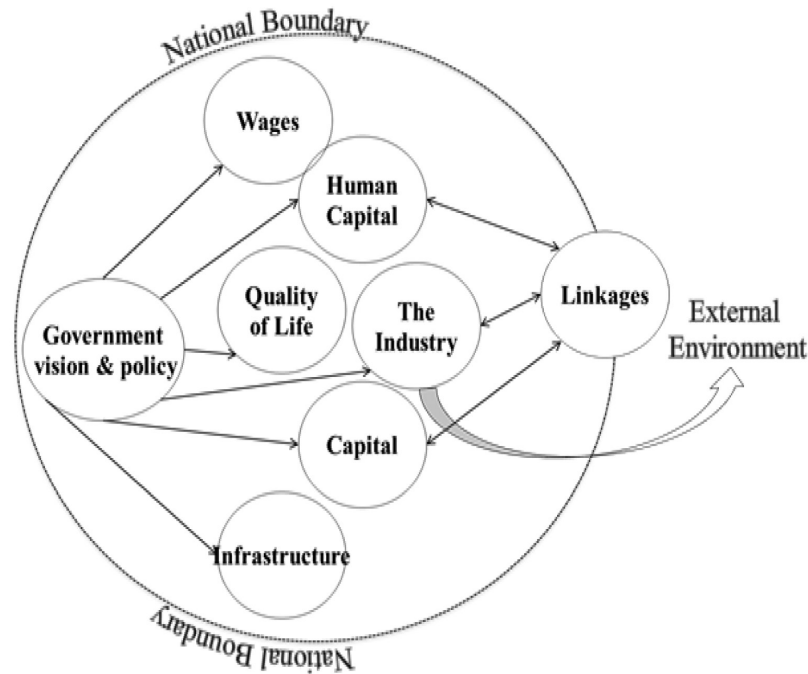


Figure 1. The Oval model

Source: Carmel, 2003

Government's vision and policy: The government can play an active and facilitating role in every factor of the model. It can influence/facilitate the development of telecommunications, infrastructure, and capital availability, including venture capital, the revitalisation of industry, human capital (through investment in education), quality of life, and wage levels. The success of many countries in certain industries also comes from active policies in their stimulation and development. In national politics, however, a distinction must be made between the start-up strategy and the follow-up strategy (Heeks & Nicholson, 2002).

Human capital: Human capital capabilities are the product of a tradition developed over many generations. Providing competitive human capital is directly related to the development of the education system, universities, vocational schools, etc. This factor, unlike others, emerges as a competitive one after several years of national investment (Carmel, 2003). The size of the human capital reserve is also important. To be competitive, a country must offer educated talents and absorb locals who graduated from other countries. Proficiency in English to integrate easily into the international market and leadership skills for successful management of the firms are two important requirements.

Quality of life: Many companies tend to establish their activity in countries with high quality of life. The main reason is the high concentration of qualified human capital. Educated people prefer cities, or countries with a moral standard of living. When choosing where they will work and live, they must strike a balance between economic opportunities and lifestyle (Florida, 2001). This is one of the main reasons why talented individuals leave developing countries.

Salaries: The goal of any firm is to look for human resources and capital where they are cheaper and sell where profitability is higher.

Industry: Some characteristics that a successful industry should have are: the existence of clusters³, the number of firms in the industry, their size, business associations, the level of development of a common vision, the standards that firms seek to achieve these, or cases of entering the market with their brands. The firms' clusters simultaneously enhance competition and cooperation within a common environment. A positive effect of clusters is the dissemination of information from experts in professional networks. Obtaining such information externally is very costly. Success in an industry's exports is directly related to the number of firms in the industry or their size (Carmel, 2003). Firms must specialise in the same area/part of the value chain: in specific services or products. The specialisation helps disseminate information within the cluster and makes it easier to identify the industry. The primary function of business associations is to promote the industry, disseminate information, and set up internal production networks. Finally, achieving international quality standards is a critical element for the growth of the industry.

Capital: (Financial) Capital is vital for the growth of an industry in the international market. The government is central to stimulating an industry through subsidies, various facilities, improving support infrastructure, etc. The primary source of capital from abroad comes in the form of foreign direct investment.

Technology infrastructure: Technology infrastructure is the level of development of communication and information technology. In the absence of developed technology, the option of joint business clusters in industrial parks facilitates connectivity with the outside world.

Linkages: Linkages between people, working groups, firms or countries arise because of geographical, cultural, linguistic or ethnic proximity. The underlying reasons for linkages among businesses in different countries are their common features. The success of an industry can also be the product of connections with the Diaspora. Incentive policies "from flow to absorb the mind" may serve to develop certain industries and cooperation with foreign companies where they are applied.

The Graf and Mudambi model (2005)

The model proposed by Graf and Mudambi (2005) serves to assess the competitive advantages of a country as a destination for offshore outsourcing. According to them, the four key factors are information and communication technology (ICT), infrastructure, country risk, government policy, and human capital.

Infrastructure: Infrastructure relates to the specific production requirements of an industry. The service industry and the outsourcing business **processes require** destinations with secure, qualitative, and low-cost ICT infrastructure. In the absence of studies regarding the effect of geographical distance on the outsourcing of activities, such distance is still assessed as an obstacle to the marketing of activities.

³ Cluster represents a critical mass of firms in geographical proximity to each other, such as firms located close to metropolises or industrial areas (Carmel, 2003).

Country risk: A country's risk may be economic or political. Economic risk comprises the following indicators: economic openness, inflation rate, exchange rate fluctuations, and the possibility of repatriation of profits, etc. Economic risk increases when these indicators change frequently. Political risk is related to political stability in the country, the intensity of conflicts with other countries, and legal amendments and rules of work and business climate.

Government Policy: Governments may influence the size or form of involvement of foreigners in the industry through barriers or investment incentives. The two key factors in the flourishing of trade activities in a destination are fiscal policy and the clarity of the scheme that the government intends to use in boosting investment.

Human capital: Studies on the importance of human capital date back to the 1990s with the role of human resources in absorbing foreign direct investment. Recently, this resource has become a special asset for specific industries. The authors identify five aspects of human capital: availability, experience, quality, level of payment, and cultural differences. An important condition for transferring to a given country is the size of the human capital reserve with proper experience. International companies may look for countries that offer such reserves. Simultaneously, they offer the opportunity to acquire new knowledge and transfer knowledge to the environments where they operate. The quality of human capital is a determinant in some industries. It includes elements such as technical expertise, knowledge of foreign languages, and managerial skills, etc. Job compensation is one of the main motives for offshore outsourcing (Abraham & Taylor, 1996; Fenster & Hanson, 2001), but if there are significant cultural differences between countries, transaction management becomes very costly (Pinto et al., 2013). Culture is central to the employee's approach to new technologies and relationships with others.

Graf and Mudambi (2005) also included moderating factors in their model. Moderating factors play an important role in the perception of foreign companies regarding infrastructure, country risk, government policies, and human capital in the priorities as advantages of a certain country. They are classified into specific factors of the firm factors in a given context. Specific factors are related to the main reasons that impel firms to outsource activities such as cost reduction, improving business processes, improving skills, etc. Situational factors refer to business processes, standardisation, and strategic importance, etc. State risk is critical for strategic processes, whereas the standardisation of the activities is impactful on human capital importance. The experience of foreign companies in the global value chain moderates the intensity of outsourcing (Graf & Mudambi, 2005).

The Farrell Model (2006)

The Farrell model (2006) is amongst the most detailed models in terms of selecting the destination country (Oshri et al., 2011). The model scrutinises six factors: costs, availability of skills, risk profile, environment, market potential, and infrastructure.

The major costs of a country comprise those of labour, IT infrastructure, real estate, and business taxes.

The availability of skills is analysed in three aspects: the size and training of the workforce, sector size, and landscape of local firms. According to Oshri et al. (2011), a proportional increase in labour force pools is important for long-term decisions. This proportional increase in human

resource pools keeps salaries low. The size and strength of a sector are measured through the monetary volume, the number of qualified personnel in conducting activities, and the share of exports of this sector concerning total exports. Assessing the skills and capacities of a supply firm serves to test its aptitude in meeting the further needs of the client, continuous improvement and readiness to coordinate the business according to the client's request.

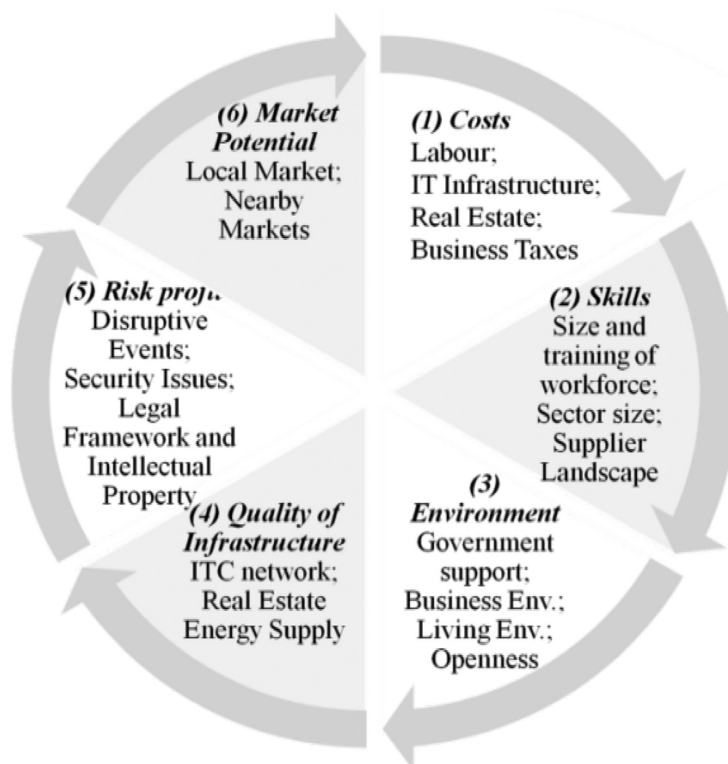


Figure 2. The Farrell model

Source: Authors based on Oshri et al., 2011

The environment includes government support, business environment, living environment, and openness in the region. Government support is related to FDI policy, the level of bureaucracy, legislation on employment, and the level of corruption. The business environment comprises cultural differences and business ethics. The living environment refers to the quality of life, the spread of HIV/AIDS, and the per capita report of serious crimes.

The quality of infrastructure is the combination of the quality of the ICT network, real estate, and electricity supply.

The risk profile encompasses opportunities for devastating events, security in the country, and strict laws on the protection of intellectual property. The devastating events are workers' revolts, political instability, and natural disasters. The security variable is related to the risk of fraud and terrorist crimes. Regulatory risks are measured through the stability, fairness, and efficiency of the legal framework. Moreover, inflation risks, currency fluctuations, and freedom of capital are considered in the context of macroeconomic risks.

Market potential is calculated according to gross domestic product (GDP), GDP growth rate, and opening in nearby markets. According to Oshri et al. (2011), enlargement in the region may occur in the following forms:

- Subsidiary, where the firm controls and manages the activity using the labour force, infrastructure, and reserves of the other country;
- Offshore outsourcing;
- Distributors in the region on behalf of foreign firms.

The A.T. Kearney model (2011)

In 2003, the A.T. Kearney Company published the first model for assessing destinations, starting with 11 countries. The aim was to provide an instrument that would serve to assess 3 factors: cost (40%), environment (30%), and human capital (30%). Cost carries a higher percentage, as it is the primary motive for transferring abroad.

Financial attractiveness: The financial advantages of a country are divided into three major categories: labour costs, infrastructure costs, tax, and regulatory costs.

Availability and skills of labour force: The categories of the labour force are: experience and quality in the offshore services sector, workforce availability, education and language, and the risk of withdrawal.

Business environment: The business environment consists of four major categories: country risk, existing infrastructure, cultural exposure, and intellectual property security.

3.3. Models Summary

Offshore outsourcing, designated as the contemporary trade of activities, is studied for the motives that urged companies to outsource, the criteria they evaluate for selecting the firm inside/outside the country, and the performance of this strategy. The choice of a foreign supplier goes hand in hand with the requirements (criteria) that the destination country must meet. Among the theories that study the factors influencing the increase in the advantage of one country over another are the eclectic theory (OLI paradigm), the theory of location, and the theory of internationalisation. The country's selection is directly related to the motives of international companies in transferring activities abroad. The government of the destination country is central to boosting investment, outsourcing domestic suppliers, and increasing exports. The two major factors in promoting the outsourcing of domestic firms by foreign companies are fiscal policy and the clarity of the scheme that the government intends to use to boost investment (Carmel, 2003). The models proposed by Dunning (1988) and other authors, presented in Table 2, have three factors in common: costs in the destination country, environment, and infrastructure. Each model proposed by the authors is within a certain context of motives, strategies, and the industry in which firms operate. When foreign companies decide to outsource value-chain activities, they are driven by different motives. The most often encountered motive is cost reduction. In all models presented in Table 2, the costs of the destination country are important in the decision-making of the companies for transferring abroad. Companies aiming to improve *business processes* and *enhance skills* within the value chain are looking for countries with developed industries for the required activities. The concentration of industries and the geographical clustering of firms tend to maximize the advantages of one country compared to other countries. If countries (or cities) manage to be affirmed as attractive destinations for certain industries, then the goal is achieved (Birkinshaw, 2000). Coombs & Battaglia (1998) describe the trade of activities as trade in services. The primary requirement in transferring activities to a

destination country is the size of the human resource pool, readiness to work 24/7/365, and the required level of qualification. This qualification is the determining factor for some industries. The quality of human capital includes technical expertise, interpersonal relationships, knowledge of foreign languages and the ability to apply new technologies (Graf & Mudambi, 2005). The environment of the destination country includes socio-economic development factors such as gross domestic product per capita, domestic and foreign trade, traditions, economic freedom, the level of corruption, etc. The development of international trade in intermediate, final products, and services has intensified thanks to trade liberalization and improvements to transport and ICT infrastructure in destination countries.

4. CONCLUSION

All the summarised models have costs, infrastructure, and the environment as important factors in choosing the allocation of their activities. Offshore outsourcing as one of the integration strategies in global value chains brings to light some important requirements for firms and destination countries, which wish to remain competitive in this global market.

First, the service industry dependent on information technology is challenged by updated programs that require not only an elevated information technology infrastructure but also a skilled workforce. Online services are a trend that has grown in particular because of the isolation and distancing due to Covid-19.

Second, business costs that have a significant weight on business performance have undergone significant growth. If outsourcing is considered a strategy that minimises costs, transforming them into fixed (as contract costs), offshoring in the literature of the Last 2 years has focused on the phenomena of reshoring and near shoring. Transportation costs have become a challenging cost in affected industries, and the rising cost of living has demotivated many female workers in labour-intensive industries. Costs as a driving factor for many destination countries must be reviewed in the long term, as it is a strategy that seems to leave behind remote countries and those with a small local market.

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Electronic Trade, Cards and E-money

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Abstract: *The introduction of information systems in the economy is a big step forward for all actors in the process. At the very beginning, there was a certain degree of mistrust of the participants themselves with the introduction of the Internet into business, but the current progress is noticeable with its greater perspective in the future. Buying goods and services online has become a need for a large number of citizens. Citizens have adapted over the years and gradually accepted the advantages of online shopping, and now it's just a question of how far these measures will go. More and more goods and services are available online to be traded. Every day more web-sites specialize in e-commerce. The paper will show the number of transactions, as well as how they moved in the last 5 years in our country, limited to card transactions and the use of electronic money.*

1. INTERNET AND ELECTRONIC BUSINESS

The integration of a large number of information systems and networks has led to the globalization of business through the global computer network. The success of a company's operations depends on finding a place in the global division of labor, thus becoming a part of global business processes, which requires operating in a computerized business environment (Stan-kic, 2007). There are fewer and fewer companies that "Try to do business outside of new frameworks and there are fewer and fewer opportunities for that. Survival in the market is almost impossible nowadays without using the benefits offered by e-commerce. New opportunities offered by doing business on the Internet are the transfer of data, large amounts of information over long distances, direct payment, delivery of services and all that, as well as a large number of services in real-time from anywhere in the world (Simovic, 2013). Through electronic business itself, electronic commerce was born. The Internet is the fastest-growing sales and marketing channel in history and the most effective means of communication in the world, so it is not surprising that its implementation in trade has created an economic boom. There is an influx through various channels Internet has come to life in the economy and gives a handful of good things, with great application in today's era.

2. ELECTRONIC TRADE

Trade is a special economic activity that has the task of organizing a regular exchange between production and consumption through its mediation in traffic. With its activity, it should ensure the supply of goods in the quantities and range that the market is looking for, at the time it is looking for, and at prices and other conditions that customers are ready to accept (Jaksic, 2006).

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All this has risen to an incredible level with the expansion of electronic business, which has found its share in Electronic commerce, which is becoming the dominant way of trading.

The emergence of electronic commerce represents a real revolution in business, not only because of its hitherto unprecedented superior technological base based on modern telecommunications, computing, information technology and cryptology (Hadzic, 2013). From the first electronic transaction in 1994 to today, several different services have been introduced through electronic commerce that offers great opportunities to users and companies. The advantages of electronic commerce compared to traditional commerce are incredible and the benefit is huge for both end users and companies.

The theory of electronic business models encompasses several basic models of business transactions. The models of electronic business are defined based on the parties involved in the business process and the nature of their business relationship (Gledic, 2010). The participants in e-commerce are:

- Business entities (legal entities) – Business – **B**,
- Consumers (individuals) – Consumer – **C**,
- Government authorities – Government – **G**.

Below, we are presenting the division among participants in the following way:

- **B2B** – Business-to-Business, refers to the collaboration or exchange of information between two legal entities, two companies, or cooperation or exchange within one corporation.
- **B2C** – Business-to-Consumer, refers to online collaboration or exchange of information between a legal entity and an individual. A crucial element in B2C transactions is the information about products and services. Regardless of people's location, the Internet enables them to access all relevant information about products and services, their quality, and possibilities of acquisition with just a few clicks of a mouse or typing on a keyboard (Stankic, 2021).
- **C2C** – Consumer-to-Consumer, involves two individuals and their exchange or collaboration facilitated by the Internet. A company supporting these transactions needs to find some unconventional method for service payments. Service payment usually involves a small percentage of the transaction, membership fees for the service, or some combination of these methods (Stankic, 2021).
- **D2C** – Direct-to-Consumer, represents direct advertising, communication, and collaboration with end users.
- **B2G** – Business-to-Government, involves government websites where tenders for public procurement are published, subsidies are allocated, or tax obligations are fulfilled (Gledic, 2010).
- **B2B2C** – Business-to-Business-to-Consumer, entails selling to end users through partnerships or the merging of two corporations (BigCommerce, 2022).
- **C2B2C** – Consumer-to-Business-to-Consumer, connects consumers using online companies as intermediaries, practical for selling used and new items between users.
- **C2B** – Consumer-to-Business, represents individuals offering their services or selling items to specific organizations.
- **C2G** – Consumer-to-Government, is a similar model as the one above, but in this case, offerings are made to the government.
- **G2B** – Government-to-Business, serves for the government to offer financing, various forms of assistance, etc., to the business customers.

- **G2C** – Government-to-Consumer, refers to services or training provided by the government to individuals.
- **G2G** – Government-to-Government, includes all services, solutions, or advice that one country's government provides to another country.

3. CARDS AND E-MONEY

The use of information technology in banking has revolutionized the way financial services are provided, to the extent that for most services we do not need to go to the bank but can do them from home, from work, or even on the move via mobile phone, at any time and we mostly use electronic money, not banknotes (Hadzic, 2013). The greatest technological achievement in the development of banking is the appearance of electronic money, and therefore electronic banking. Electronic money is defined as specific monetary information” that is transmitted utilizing electronic impulses in real time” between transactors who make payments (Stankic, 2007). Payment cards are non-cash payment instrument that allows you to pay for goods and services and withdraw cash (National Bank of Serbia, 2007). We divide payment cards into credit and debit cards. Debit cards are cards that allow us to withdraw our available money, which also includes the permitted overdraft, i.e., permitted minus. The opposite of them are credit cards, which allow the use of money that we currently do not have and we have an agreed limit with the bank. Prepaid cards are cards with pre-deposited value on them. Funds are deposited on this type of card by purchasing electronic money that is on the card and is available to the user for spending at designated points of sale for a certain amount of real money. These cards can be single-purpose or multi-purpose (Simovic, 2013).

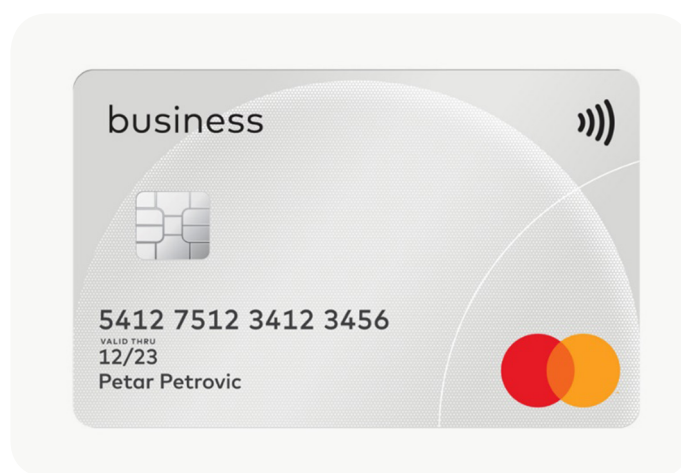


Figure 1. Mastercard

Source: Mastercard, 2022

The table shows a five-year overview of purchases of goods and services via the Internet in Serbia, the overview includes purchases using a card and purchases using e-money. A moderate increase is present in every year shown in comparison to the previous one, except for a strong jump from 2020 to 2021, which, according to everything shown and analyzed, followed the impact of the Covid virus and everything that it brought with it, so the use of electronic commerce in that period in a big increase compared to other years. Thanks to its wide and limitless application, the great opportunities offered by electronic commerce are also available to user companies in Serbia, and the expectation is that the growth will continue and that the results will be even better.

Table 1. Payment transactions of the purchase of goods and services via the internet

	2022	2021	2020	2019	2018
Purchase using a card	30,319,594 81,112,211,678	22,641,921 55,454,047,993	14,188,856 32,235,014,623	6,970,722 17,783,001,065	2,813,939 9,267,804,195
Purchases using e-money	132,082 244,069,102	214,868 358,721,310	127,500 144,736,455	55,530 60,743,830	33,326 57,797,809
Total	30,451,676 81,356,280,780	22,856,789 55,812,769,303	14,316,356 32,379,751,078	7,026,252 17,843,744,895	2,847,265 57,797,809

Note: The blue numbers are the number of transactions made, and the red numbers are the value of those transactions in RSD

Source: National Bank of Serbia, 2022

4. CONCLUSION

One of the definitions of electronic commerce that gives the simplest explanation is in the Law on Electronic Commerce, where electronic commerce of goods and services is a form of distance commerce (Official Gazette of the Republic of Serbia, 41/2009, 95/2013 and 52/2019). The Government of the Republic of Serbia, Ministry of Trade and Services (2022) has prepared a Guide to online shopping to make it easier and closer for users from Serbia to use electronic trade. The advantages offered by e-business, e-commerce, as well as e-banking are that the quality of service increases with fewer employees, costs are reduced, availability is set to a maximum of 24 hours a day every day of the year, a large number of users, easier data processing, immediate processing and carrying out transactions, as well as a host of others.

With the information revolution, which follows all these processes, the consequence that every company faces is that it has to become globally competitive, even if it sells only in the local or regional market if it wants to survive in the market. Competition is no longer local, it knows no borders, and every company must become multinational in modern conditions. Investing in information technology gives results in all fields, both for companies and for the population, everyone benefits from it.

There are various predictions, one of them is that the traditional form of banking will disappear because they are increasingly threatened by modern IT-oriented companies. There are great expectations and predictions regarding the Internet itself. Electronic commerce in the world and its growth has been transferred and implemented in our country as well, which can be seen by the number of completed transactions, as well as by the amount. It is evident growth from year to year, as well as with the investments in information technology which are noticeable and which are the mediator of the growth of e-commerce in Serbia. A large difference caused by the impact of the virus was noticeable, but the growth stabilized already the following year as the impact of the virus and everything that followed began to weaken. There is no place in sight, nor is there an obstacle that is insurmountable for the progress of electronic commerce both in the world and here, it has even opened a handful of opportunities to all countries of the world, regardless of status, possibility, and location.

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Economic and Security Paradigm: The Ongoing (R)Evolution?

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Abstract: *The history of technological changes has confirmed its impact on (r)evolution of security concepts and paradigms. However, it is not an unknown correlation and has its roots in what Kuhn has been defining as the normal science problem and eventually scientific revolution. Civilizations' history has proven the impact of technology on societies from the wheel to the cyber. And whenever Kuhn's normal science or current patterns and solutions were unable to solve rising challenges and changes the new (r)evolution rise and led to the paradigm changes. Respective has an impact on the economy, security as well as economic security. Each one of them is the core subject of evolving and the rise of the new subject's paradigm. Distinct impacts on security as well as the concept of individual security are the core focus of this article. In addition, it is a consequential attempt to identify the common denominator between security as the concept as well as its subconcepts like individual security, economic security and corporate security. Changes in technology especially cyber security concepts and machine learning followed by artificial intelligence are the drivers of the (r)evolution of the paradigm in the economic security context. Similar to the technologically impacted Cold War arms race, the new IT arms race is one of the identified outcomes of the evolved paradigm in security. It seems like a similar yet differently driven impact. Finally, all aforementioned is changing the future of security in general but also in particular concerning changes and impacts on individual(s) security. Therefore, it is highly important to understand and follow respective changes including paradigm shifts. And unlike Goethe's view on technology, paradigm shift understanding might support us within the challenges.*

1. INTRODUCTION

Perspective and the way of observing the process and/or notion can be defined as the paradigm. Concepts, ideas, definitions, and findings have been impacted by continuous societal changes. New knowledge, new previously unforeseen challenges, experiences and consequentially new solutions change the paradigm(s). Following Kuhn's framework, every paradigm is evolving when up to then normal science is unable to respond to new challenges and problems. Kuhn's approach and framework can be easily applied to any current and future social and technological process. The paper's idea is current *security normal "science" is not able to solve newly defined and arisen challenges impacted by the new technological changes which consequentially impact paradigm shifts*. It has been evident that positive correlation between technological changes on one side and paradigm shifts in economy, security and cyber-related concepts on the other side (Jovetić, 2020). Papers' idea is to additionally reflect the impact of technology on distinct forms of security.

Economic security including the link with the cyber security impacts on the economy and market usually have been ignored up to a certain extent. It can partially be due to the dominance of the standardized and generalized approaches to the concepts of security in which it has been seen

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as the primary state's concern and obligation. However, a set of relatively new risen actors, concepts, modes and roles identifies such approaches as highly inadequate and even falsy dangerous. It is almost impossible to accept or at least understand an individual's liberation due to the impacts of technology and to ignore or at least neglect the same impact on the concepts of economy, security as well as their future constitutions.

One of the highly important subconcepts of security due to the technological impact and consequential technoeconomic and social changes is individual security. Because firms (SMEs, companies, corporations, etc.) are one of the most vivid and present organizational forms of individual entrepreneurial endeavors it is indeed expected to frame consequences and impacts on corporate security due to changes (Jovetić, 2021).

Probably one of the most remarkable examples of technoeconomic changes are cyber security challenges. Higher anonymity and attribution issues are the core element of the respective challenges precisely due to technoeconomic changes. Consequentially, direct expenditures of respective institutions are increasing either regardless of whether it is about prevention or recovery and/or diminishing the negative outcomes. Respective quite demanding challenges do require demanding and comprehensive approaches including rising the importance of all respected stakeholders' cooperation.

2. THE SECURITY PARADIGM?

The means and the methods of warfare had been transformed ever since the arrow and bow by the technological advancements but also economic and socio-political changes.² In that regard, respective changes are transforming the paradigm of security in every context. The current form of globalization is an era of tremendous changes and transformation mainly because of the two core elements of nowadays technology. First, the current form of technology is being defined mainly but its *complexity* and second, current societies (individuals, companies, and even states) are tremendously *dependent* on technology.

Risk society as defined by Beck, comprehends a society in which the complexity of technology increase leads to the increase of the risk in the respective society (Beck, 1992). According to Brauch (2005), Cicero and Lucretius introduced the notion of the paradigm of security when they framed it as the psychological and philosophical mind state. More precisely and again according to Brauch (2005), they referred to the freedom from sorrow and subjective feeling. At the time, newly concept continued to frame security paradigms also within Pax Romana where it has been indicating a form of politically stable and further secure concept (Brauch, 2005). Its glory started to rise even more in the XVI century. At the time, it became a public security concept claiming the obligation of vassals to support the ruler in wartime as well as the obligation of the ruler to support the vassals in the peace periods. In the XVII century, this respectively framed the idea that only a sovereign ruler i.e. the state can provide a security framework for the "citizens" i.e. individual(s). The respective has been further framed in 1648 by the Peace of Westphalia when sovereign states have been seen as the core security actors in the international political order. However, in the same historical period, precisely in 1651 Hobs had defined the idea that individuals are objects while states are subjects of the security paradigm. Development and strengthening of national romanticism as well as nationalism are part of the 18th century. Consequentially, during the 18th and 19th centuries

² Economic and technological changes since the very beginnings did have tremendous impact on security and defense measures and methods.

began the process of establishing the state as a central referent object of both, identity, and security. Two world wars as well as the followed-up Cold War somehow strengthened the states' position as such in the paradigms of security. New geopolitical, technological and economic changes had several impacts among which the most prominent ones are: (i) liberation of individual(s), (ii) partial impact to the fall of the Berlin wall, (iii) the end of the Cold War and (iv) transformation of state's notion in the paradigms of security. Due to respective changes, the state ceased to exist as the exclusive central referent object within security paradigms. Furthermore, concepts of security became more comprehensive, started the inclusion of many actors as both, security's subjects and objects as well as started including new elements of security such are economic, ecological and social safety and security. According to Ejdus (2012) individuals, interest groups, regions as well as the international system itself became the new potential referent objects within the paradigms' of security. The rise of rogue states, organized crime and other violence-based networks but also the transformation of the supranational institutions such as NATO has followed the expansion of the security objects in the slowly rising transformed security paradigm. Respective has also been confirmed by the existence and then scope and role of the NATO Strategic concepts in the 1999-2010 periods.

Theory suggests and it seems that practice confirms that *security* is a *disputable concept in its essence*. Baldwin's (1997) statement is mainly based on the vast number of definitions of security. In addition, it is become even more "disputable" when adding Wolfers' (1952) thoughts about *subjective* and *objective* concepts of security in the overall equation. Objectively contextualized security refers to the measurement of the absence of the threat. In other words, it is evaluating whether the *basic socially adopted values* have been *under threat* or even already *endangered*. However, the respective concept does not and cannot exclude the absence of threats. In this context, perceiving security as the absence of threats might be general but also not the most viable and adequate definition according to Buzan (1983). On the other hand, subjectively contextualized security refers to the *lack of fear* regarding basic social values current or future endangerment. It is also important to add this paper is on the Ejdus' track (2012) regarding the correlation between threats and security. They are the same coin pair because in any form of security or any paradigm of security, threats or risks are the core element as they are its *raison d'être*. It is highly neglected in precise format within the current contexts that threats are the cause of security which is a derived consequence. Comparing Buzan and Wolfers enlightens two different aspects of the security's central element: (i) first observes it more as the *tendency* not the *lack of* threats absence while (ii) second observes it more as the measuring of the threats absence. Respective is becoming even more important in the cyber security paradigm context due to anonymity, secrecy, lack of attribution and especially ex-post identification, measurement, reporting as well as recovery. The divergence between *anticipated risks* and *non-anticipated threats* made by Beck can be quite beneficial in the respective context. Even though it is "known" it is highly important to enlighten the blurred line regarding only ex-post possible measurement at least in the real world. Solely ex-post the danger/threat identification is possible and this is becoming highly important in the new and future cyber-based-security paradigm.

3. THE PARADIGM(S) OF ECONOMIC SECURITY?

Technological advancements and (r)evolutions of the late 20th and early 21st century directly impacted the concept and context of security in the economic realm. Precisely, they transformed and (r)evolutionized the paradigms of economic security (Jovetić, 2021). Smith's ideas of peace and free market correlation have been the cornerstone also for the liberal peace theory as one

of the security studies paradigms. Moreover, it is also important to emphasize that security can and should be seen as an economic resource (Vukotić, 2011). Respective is practically confirmed by unfortunate events in the Western Balkan for example within the 1912-1999 period in which 11 i.e. 1 at almost every 8 years armed conflicts have happened. Furthermore, that led to the inability of respective societies to create wealth and prosperous systems and that is why economic and individual security must become even more important than they are today (Jovetić, 2013).

Following the previous contextualization of security done by Wolfers (1952), it seems it can be also applied to economic security. Consequentially, according to him, economic security can be identified as the *absence of the endangerment of the core economic values* or in other words *measurement of the economic dangers and risks deficiency*. If observed in the narrow sense there are some meanings of the economic security concept. Firstly, it can refer to the *production and exchange of goods having a divergent impact on the defense capabilities* of the state; secondly, it can be seen as *an instrument of the economic policies which can or is used as the tool of the defensive or offensive security policy* which also includes restrictions and sanctions on one side as well as economic support on the other side; thirdly, *ability to preserve the level of the economic development* used as the form of security but also the supporter of the respective state's role in the respective international order; fourthly, the form of the *individual(s) security* mainly in the realm of the access to the essential goods as well as in the broader realm of stability in social and economic-related context and fifthly, *context related to correlation with the wider and global environmental, social and economical equilibrium* (Beck, 1992). Individual(s) but also social-economic virtues safeguarding are the core elements of economic security. Furthermore, economic security also refers to the safeguarding of uninterrupted market-based exchange but also the creation and protection of certain economic development which is in general the cornerstone of the system's stability and security firstly and individual(s) security, secondly. *Production and exchange of goods* and the *ability to preserve the level of economic development* are crucial notions of economic security in the narrower sense. It also seems there is a significant and direct correlation between the aforementioned and the core security function of any observed system whether state or supranational entity. Moreover, it is strongly believed that the core security's (pre)condition is economic security as also mentioned here before. Respective correlation has been identified throughout techno-economic and the history of civilizations. One of the additional arguments for the aforementioned is the fact that the economic power of the states rather than seen as the power of purchase is the driver of the security power transformation and reshaping of any observed state (Jovetić, 2020). It is worth noting that economic power's importance has been significantly noted during the so-called public debt crises and in the realm of limited and scarce resources. Great powers or systems (whether empires, kingdoms, or nation-states) have capacities and abilities of survival but also development has been significantly interlinked with its economic capacities. Respective has been noted by Kennedy (1989). It is also important to note that the opposite course is quite significant. Respective is at least for two reasons: (i) noting that security is an economic resource that provides conditions for growth and development and (ii) provides also framework (mainly for great powers) to reach both, broad and comprehensive internal security but also their strong global role and position in the respective transnational context (Jovetić, 2020). The valid and actual argument for the aforementioned can be found in the *National Security Strategy of the United States (2010)*. The document identifies American economic power as the primary element and source of both, hard and soft power including the legitimacy of the global leadership.³

³ Probably, China can or is doing the same due to the rise of its economic power and impact.

It has already been emphasized the central element of the economic paradigm of security are the threats that are or might be endangering its existence and preservation. Particular elements of distraction are in line with Ejodus' (2012) three-threats-levels-distinction comprehending individual, state as well as the international system level. Hunger, poverty, crime, violence, illness, and terrorism are the core individual-level threats. Poverty is also a state-level risk. From the economic perspective, GDP per capita measurement is the core indicator for such risk in any kind of analysis. A certain analysis has been done by Rice et al. (2010) and it states that countries with lower than USD 250 GDP per capita do have a significant 15% higher chance to face a civil war. At the same time, the corresponding probability significantly falls to 1% when countries with USD 5000 GDP per capita are about. State-level risks and threats also comprehend energy in the context of its deficit and importance for maintaining the economy and therefore security. According to Pascual and Elkind (2010), energy security comprehends at least four streams such are energy goods availability, availability at the market, and up to a certain extent predictable prices, reliability of energy services and environmental sustainability. Energy is also a global-level threat which can be seen by NATO's drafted significance of it in all core and strategic documents. This is also related to new energy-related threats. Energy is seen as a critical infrastructure. Therefore, the impact of cyber risks and challenges to reliability in this regard is quite important. Aside the energy there are some other threats at the global level. Mainly they can include globalism (not globalization), corporatocracy, partitocracy, global design of the economy, monopolies, protectionism, conventional terrorism (whether former Al-Qaida or Somali pirates), unconventional cyber-based-terrorism (Estonia's example) as well as up to certain extent global economic interdependence. The impact of the latter can be seen in the effects of spill-over in the cases of financial and debt crises. Also, certain arguments related to corporatocracy and partitocracy can be found in the works of Elzesser (2009) and Perkins (2012). Some of the threats have significantly been confirmed during the Covid-19 pandemic. Moreover, the pandemic has shown that one of the important global-level-threats are health-related issues and challenges. Finally, conventional security-related interdependence is also quite an important global-level threat. This can be seen in the cases of firstly Crimean attack and then, consequentially, Russia's attack on Ukraine and all the issues risen from that from migrations, casualties, energy prices, market impacts and the necessity to rethink all security paradigms. However, one of the core threat-solving elements can be seen in the realm of economic freedom and derived individual(s) and development of the societies.

4. WHAT (IS THE) TECHNOECONOMIC CHANGES IMPACT?

It seems that the current theoretical approach as well as bibliographic sources relates to both, security and defense in the realm of society and the state while partially or fully neglecting the individual(s) realm. Having in mind attachment to the ideas of classical liberalism, freedom of the individual, and philosophy of freedom it is crucial to update security definitions and paradigms in that context. In the aforementioned context, it is important to note that the initial premise is that individuals are free by birth and that the freedom of each individual is guaranteed by the forms of the social contract(s). Objectively contextualized individual(s) security is related to the lack of threats regarding life, property, or any correlated right of each individual. On the other hand, subjectively contextualized individual(s) security is related to the lack of fear regarding jeopardizing the core individuals' values. Freedom is general and not partially owned. Therefore, it is highly important to emphasize that with freedom comes also an obligation in the form of security preservation. Pair freedom-security meaning that each one's freedom is being limited by other person's freedom is seen as its key notion. Relevant is also valid in the cyber world realm because even their individual(s) security should have been seen both objectively

(measurement of lack of jeopardizing the individuals) as well as subjectively (measure of lack of the fear regarding jeopardized core values) frame.

Company regardless of the form, size, shape, or legal basis i.e. whether is it a startup, SME or giant corporation should have been seen as a form of entrepreneurial and managerial organization of individual(s) endeavors. In that regard, the security of the firm, or corporate security as more frequently called has to be seen as one of the core subelements of the individual(s) security concept. Primarily, as it is directly linked to property-wealth acquisition and achievement elements within individual(s) economic security. Almost like any (economic) security element, company security can also be subjectively and objectively contextualized. In the first case, it *refers to a lack of fear that the firm and/or its core values will be jeopardized in any way*. In the second case, it refers to the *lack of any firm's rights jeopardizing including property, assets, systems, intellectual rights, employees, clients, etc.* Consequently, it can and should be assessed in the cyber realm context. And, it that regard can again be differently contextualized in both, subjective and objective manner. In the first one, it refers to the *fear measurement regarding the jeopardy of the core values* while in the second one, it refers to the *measured absence of any form of jeopardy regarding the firm itself*. The security of the firm or company can be distinctive up to a certain extent due to the size element. However, the security of the firm is indeed distinctively positioned but also challenged within the cyber world realm. Moreover, corporate cyber security is one of the elements of general corporate security. Within the cyber security context, there is an important security element regarding any firm related to the Internet as the infrastructure. In that regard, one of the most frequent and common risks for respective firms is related to the Distributed Denial of Service or DDoS. It is a form of an attack whose aim is to steer tremendous Internet traffic to its target to make online access whether services or transfers completely unavailable.⁴

Similar to the transformation of the global economy, global security concepts and paradigms have faced similar shifts. One of the common denominators relates to the rise of the vast number and profile of private actors and providers. The immersion of private actors is not unique to the current form of globalization and/or technological change. Moreover, it is something that has been already established in the past with East India Company and/or West India Company as one the “prominent” examples of previous forms of *globalism* at that time led by some former great powers.

In today's world, hard power companies are mainly replaced by soft power companies such as Kaspersky Lab (KL) for example. The KL also did a tremendous job related to the assessment of the cost price of the DDoS attacks to the firms regarding. Data from KL's “*Global IT Security Risks Survey – Distributed Denial of Service (DDoS) Attacks*” identifies the range for such cost prices based on the firm's size. According to them, the respective interval is from 52 thousand to 444 thousand US dollars. On the other side, it is rather difficult to assess the value of reputation risk and reputation loss in case of significant client base or client relations harm. Particular survey also provides additional consequences of DDoS such are non-permanent loss of access to business data, inability to conduct core business operations and communications, loss of contracts and additional opportunities either because of inability to operate or due to reputation risk, credit rating risk as well as future increase of insurance costs. Aside from DDoS, there are also some other important and costly forms of attacks and threats such are malware, web-based attacks, ransomware as well as internal cyber threats. The common denominator for each is the rise of their cost price globally as well as per industry.

⁴ www.digitalattackmap.com

An additional and quite neglected element of a firm's security are IoT devices. The key element of respective devices is the fact that they are not made or entitled to security at first glance. Security issues of the IoT devices, as well as their rapid increase in usage, determinedly lead to increased cyber attack surface due to the intensive interconnectivity among them as they can be used as multiple attack entries.

Critical infrastructure is probably the most desired target of any "serious" terrorist or war-inclining group. Therefore, its protection is one of the core elements of each, societal, economic and individual(s) security. According to the available data and research made by [Cavanagh \(2004\)](#), companies are the owners of 3/4 of the current US critical infrastructure. Scope and usage of critical infrastructure and its relation to individuals, other businesses and goods and services exchange is tremendous. It is impossible but also meaningless to isolate the critical infrastructure and its personal and commercial usage. Based on that it has already become part of both, economic as well as individual(s) security paradigms.

Isolation is quite an impossible task in a hyper-connected and hyper-changing world. This also leads to many risks and challenges. And it is particularly valid in the cyber world. It is strongly believed that real-life issues and tension do have mirror-like counterparts and reflections in the cyber domain ([Jovetić, 2013](#)). Cybercrime is not an exception at all. Research made by [Accenture/Ponemon Institute \(2019\)](#) shows that data for 2017 and 2018 shows that the most viable and the most successful industries are the most targeted and consequently the most affected industries in the context of the expenditure. Therefore, industries such as banking, infrastructure, energy, high tech, auto industry, capital markets, insurance, software, etc have an expenditure interval of 10.6 to 16.6 million US dollars in 2017. The interval for the same industries has been even higher for 2018 ranging from 13.8 to 18.4 million US dollars. Similar conclusions are valid for countries as well. The more prominent, developed and globally successful nations, the higher the expenditures of cybercrime. In the most developed such as the USA, Germany, and Japan figures goes in eight-digit figures in millions of US dollars.⁵ It can be also concluded that the level of economic development is *positively* correlated with the cost price per year.

Again, according to some data including [IMF and Lewis \(2018\)](#), cybercrime holds a solid third position as the most "valuable" global crime "industry". The calculation of the cybercrime value is rather difficult to assess for numerous reasons and primarily due to a lack of comprehensive and overall data and information. However, based on some estimations the "value" is 375 billion, 400 billion, 575 billion and even 2100 billion according to McAfee, Lloyds, CSIS and Juniper Research, respectively.

4.1. Cyber-security insights?

Each one out of the three important cyber-security layers i.e. individual(s), corporate and societal have certain common denominators in this regard. Firstly, there are cybernetics goods i.e. services and products. Secondly, the occurrence as well tremendous usage of IoT devices as well as their interconnectedness. Thirdly, machine learning comprehends deep learning or even more popularly coined artificial intelligence. Particular is highly important as Internet has already become the attached or even integral part of almost every single business. Numerous activities from online presence, clients communication and accessibility, data usage and archiving, reporting in a financial and narrative context, sales, payments, traffic, monitoring, etc are

⁵ There are no data for some countries like China in the report.

already Internet based and used either web or applications based. And still, this is before any metaverse concept or context or even any singularity approach and idea. If anything of date develops or even if something else develops before it, there are significant chances regarding further world cyberization or technology advancements in the context of physical and virtual world “integration”. If or whenever that happens, it will for sure increase the cyber-security risks associated with as well as the challenges required to answer. Consequently, it has led to additional *scientific revolutions* and the quest for new security-defense tools and mechanisms.

Many authors including [Lewis \(2018\)](#) believe in the continuation and even increase of cyber risks and cyber-based attacks. Among numerous reasons for such claims, some seem quite interesting for further analysis. Firstly, criminals are keen and possess tremendous velocity in the acquisition and usage of new technological advancements. Secondly, one of the spill-over effects of technological advancement is a rapid increase of its users; combined with their origin from developing countries without proper cyber security leads to more opportunities for rouge actors. Thirdly, increased sophistication of criminals regarding higher conversion and monetization of illegal activities. Fourthly, a potential increase of artificial intelligence applications in their rouge activities. Fifthly, an increase in the cyber centers' networks. Sixthly, potential usage of the cloud for malware burrow but also the initiation of the attacks. Seventhly, the pace of technological advancement or precisely decreased costs of cyber-crime usable goods as well as their increased accessibility both on regular and especially black market. Probably, some authors would add cryptocurrencies as an increased crime activity tool. However, without neglecting the potential of some for such usage, the blockchain ledger-based ones are not fully applicable for such activities. Another element that can be “beneficial” for cyber-crime: the nation-states. Due to the numerous reasons (from revealing the data through terrorism-related goals to accessing the capital and making harm to adversaries), they can conduct respective operations as they usually require extensive forms of both, human and financial capital.

Machine learning, automatization, robotization, and correlated concepts can have a certain impact on cyber-security risks and challenges in each known context. Military-related robotization could be seen as divergent in the context of individual(s) security. Firstly, it could have a positive impact on replacement individuals as soldiers and actors in some more dangerous tasks and actions and therefore impact potential casualties decrease ([Jovetić, 2021](#)). Secondly, it can have a significantly negative impact through issues regarding autonomous decisions and the inability to make civil-military target distinctions in some cases by AI itself ([Jovetić, 2021](#)). Robotization in non-military contexts i.e. economic context can also have both, negative and positive effects. Firstly, negative effects are mainly regarding restructuring of the labor market needs and loss of certain types of professions which further can undermine the individual(s) security concept itself. However, professions i.e. labor market restructuring have also had a positive stream in the form of new, currently non-existing jobs and professional creations but also an increase of meaningful non-repetitive tasks for individuals as well as higher own leisure time.

It also seems that machine learning and consequently AI can be the new cold war domain. Potential benefits from the AI itself are based on the ability to automatically learn and improve based on own experience as well as further outcomes in the form of optimized “defined” outcomes decision-making. Having all that in mind it can be strategically offensive but also defensive ability and it is now wonder to see developed and other nations even start so called AI race. The current front runners of the potential AI armed race are USA and China. And respective is being confirmed by some distinctive data and insights. Firstly, according to the Munchen

Security Conference and its 2019 Report, there have been US investments in AI of 43 billion, China's investments of 7 billion as well as the rest of the world's 8 billion USD. Corresponding is perhaps even more evident in percentage-based comparison where the USA accounts for 74%, China for 12% and the rest of the world for 14% of total global AI investments. On the other hand, according to Lee (2018), China already has become the world's largest data producer. This is highly important having in mind that enormous scope and amounts of specific data are essential for AI learning and practicing to make optimized decisions for desired outcomes. Moreover, Lee (2018) believes that in four defined AI waves (Internet AI, Business AI, Perception AI and Autonomous AI) USA is currently better compared to China where it has an advantage in Business AI as well as Autonomous AI. Also currently, they have been equalized in Internet AI while China has an advantage in Perception AI. However, his five years projections imply that China will have an advantage in Internet AI and Perception AI while they will be equalized in Autonomous AI. The latter can represent the most significant reason for the new artificial intelligence arms race. AI on its own and especially if become a core element of the arms race will tremendously restructure economic, political and global relations. Whether it will be a form of Lee's *technological colonization* it is to be seen but it is almost certain it is already becoming one of the major security, both in general and specifically in cyber, challenges. It also seems that AI-driven challenges are not only military-security but rather techno-economic.

5. CONCLUSION

Technological and technoeconomic changes are (re)shaping the global landscape since the very first civilizations and inventions. Regardless of the type, period and currently perceived impact of each innovation starting from the stones followed by the wheel and reaching the radar, the Internet or machine learning has had the (re)shaping impact on each, society, economy and security. The security and the economic paradigm (r)evolution has been (re)shaped in numerous *scientific (r)evolutions* as they have been failing to address properly the new economic and security challenges derived from the innovation, inventions and technological advancements (Jovetić, 2020). An additional feature of the advancement in technology and its everyday life applications is tremendous *velocity*. Global interdependence, interconnectivity and velocity of the changes are the key differentiators of current globalization to any of the previous forms of civilization's advancements and progress.

Cyber risks and challenges are (in)direct outcomes of rapid progress and technological advancements as well as economic development. However, the very same sources are also (in)directly in charge of the current and future responses to cyber risks and challenges. Technological advancements have (re)shaped security context as well as the core notion of such concept including core interpretations but also security's (in general, economic, individual(s), corporate or business as well as additional sub-domains of the security) context and landscape. In addition and based on the aforementioned, it is important to note that general as well as sub-domain concepts of security are becoming more and more overlapped and intertwined as ever before. Furthermore, the technological development also (re)shaped the security scope and has "introduced" new adversaries as well as new global actors (Jovetić, 2021). It seems consequential, to claim that every previous and especially any new development of technology will introduce new risks, threats and challenges for security (Jovetić, 2020). Particular is fully in line with Beck (1992) who has been claiming that the increased risk is an outcome of the advancement of technology. Comparison of concepts and analysis of the relations between causes and induced effects has confirmed thesis validity. It also has to be stressed that there cannot be divergencies

between impacts on individual(s) security and impacts on the security of corporations. Furthermore, due to the role and importance of business to societies, it is evident that their security (intertwined deeply with the core individual(s) security) represents the most fragile element as well as the most frequent object of the attacks.

Again, in line with Beck (1992), further technological advancements will induce new forms and shapes of cyber threats. In line with Kuhn's ideas, it will be a continuous clash between *normal science* and *scientific (r)evolutions* due to firsts' inability to adequately responds. In Kuhn's world, such inability has been leading to *breakthroughs* coined as the *scientific revolutions* which consequently become the new *normal science* after solving the problem(s). Respective can also be fully applicable to new responses, solutions and concepts of constantly evolving cyber defense. Currently viable and probable responses should include: (i) implementation of the basic security solutions including investing into the technology of defense as on the level of each device type and as on the level of advancing cloud technology; (ii) institutional and legal cooperation of international actors and stakeholders including increase of the ability of global institutions and networks to examine, research and investigate in slightly depth form; (iii) increasement of the developing countries capabilities in the cyber domain which also must include cyber infrastructure in all forms; (iv) setting up the standards of collecting the threats data in more comprehensive and advanced manner; (v) setting up the global actors and institutions pressures to the any other actors (including nation-states and rouge-states) which inclines to support and/or fund cybercrime; (vi) creation and execution of global strategic alliances in respective domain which should include public and private, corporate, individual, network and interest group stakeholders (Jovetić, 2020). Framed potential responses could also have an impact on the redefinition of security in the traditional context which is non-existing excluding only some theoretical debates as well to impact future relevant definitions and concepts. The described framework is not without some disputable issues and elements and mainly they are related to the general issues of the cyber world i.e. attribution problem which can especially be challenging regarding potential sponsoring states. In addition, political context and political connections and interests between the states that should have undertaken the pressure and the ones that must be under pressure (in case they are potential cyber-crime sponsoring states) can be also a tremendous problem as the developed world sometimes value highly own particular interests comparing to the interests of the global community and individual(s). Standardized advanced collection of threats data, increase and strengthening of the defense capabilities, and investment in different forms of defense technology seem to be usable and effective tools for threat detection, prevention and response.

Technoeconomic (r)evolution in its current form such are cyber, machine learning, artificial intelligence, robotization, etc. have a remarkable distinction – exceptionally fast development and evolution drive inevitable and (un)imaginable changes. Based on the previous research (Jovetić, 2020) it seems that *technological determinism* should have been seen slightly differently compared to the dominant literature. It is currently perceived as a provision of similar and sometimes even identical impacts and/or patterns based on technological advancements. However, it rather should be seen as the *determined* introduction of the change(s) regardless of their impact, patterns and/or form. Later can have an important role in the additional understanding of the new paradigms of technology, economy and security. Further, it can also confirm the correlation between historical patterns of *advancements in technology* also perceived as *scientific (r)evolutions*. Framing in Kuhn's world it also seems important to note that similar to science in general, technoeconomic paradigms as well as paradigms of security are not and cannot be evaluated as neutral. All of them have been framed within the subjective set of values of the authors, researchers and scientists.

Individuals are the core creators of technological advancements as well as technoeconomic paradigms. Consequentially, it means they have the power of (miss)usage i.e. (non)ethical context of technology. Each technology has had impacts on the creation of new threats and risks as on the creation of potential responses to them. However, the creators of the aforementioned are individuals (scientists, researchers, entrepreneurs, innovators and even politicians sometimes) not technology per se. Friedman (1962) believed that ideas have consequences. Corresponding is fully confirmed in the case of technological progress. Vukotić (2011) believes that the technology-individual pair has both sides' impact and that *our opinion, ideas and innovation* also impact technology and due to that technology is not value-neutral. This is indeed in line with Adam Smith's thoughts in the Theory of Moral Sentiments. Consequentially, if science and technology are not value-neutral it means they are morally based.

Individually impacted and morally based technology essence derives to important elements: (i) new security paradigm and (ii) new (techno)economic paradigm.⁶ However, they strongly overlap and interwind. In the security context, we are witnessing to rise of individual(s) oriented security concepts i.e. *human security concept*. Despite the fact it is not a new one it has risen due to technological progress, global stage changes and the ascent of the human rights concept. Individual(s) i.e. human security concept is being consisted of (i) economic security; (ii) food security; (iii) health security; (iv) environmental security; (v) personal security; (vi) political security and (vii) community security. Framing the security concept around individual(s) with elements such are economic, personal and community security is a highly adequate concept for the new global stage. Moreover, the identification of personal, political and community security is emphasizing the surpassing of the nation-state security concept as the only relevant one.

Respective impacts the idea of new (techno)economic paradigm ascent. Questions such as are specific position and relation of security within it, the importance of each different identity's protection, the existence of increased humanity paradigm, etc. require answers. Potential *answers* can be found within Smith's classical liberalism philosophy and Akerlof and Kranton's (2012) economy of identity. Ideas contexts indicate there is a fusion thread between economic and moral-driven motives. A potential such thread can be the notion of security's utility function. In cases of individual(s) security endangering not even rough profit does not have its utility and this leads to the importance of wider observation of the security paradigm.

Smith (2008) defines motivating feelings either as virtue or as vice. He also believes that some basic principles motivate individuals toward the well-being of other individuals. According to him respective feelings can be observed concerning *cause* or *motive* rather than also the content's *purpose* or *impact* it produces. The motive of the feelings must be the individual(s) or human security.⁷ In addition, the impact such feelings and virtues produce is also the production of foreseen security concept. Smith's philosophy provides the basis for such thinking. Namely, he believes that different individuals' societies can continue their existence exclusively based on *derived utility* and even without duties and gratitude. Therefore, seems that 21st society's survival depends on *compassion utility*. Smith's humanity also means duty and compassion feeling while he also believes that our virtues i.e. behavior contribute to the system. Ultimately, virtue has distinctive goals and role shapes for Smith: (i) prudence as happiness self-care and (ii) fairness and compassion as care for others. He considers virtue as a contribution to society's improvement as well considers

⁶ Tremendous overlapping between technology and economy lead to creation of unique technoeconomic paradigm.

⁷ Respective motives simultaneously belong to self-care context.

responsible behavior as the key contribution to the creation and development of well-being. Can security be defined as an economic and compassionate resource?

Kaku and Dixon follow Smith's ideas. Kaku (2011) considers our common societal value as the wellbeing of others. Dixon (2011) claims that our values represent society's cornerstone, and they represent new political thinking and occur in infraction times. Believing in *corporate responsibility* and *global citizenship* Dixon confirms Smith's compassion and virtue thesis and ideas. It seems that societal values, moral and new political thinking are stepping on the global stage in new acts. Societal values based on compassion, and morals as the new technoeconomic paradigm as well as political thinking framing respective processes and positing them into the individual agenda represent the elements of the global stage act. Moreover, morality and compassion alongside culture are the potential frames for the *limitation of the unlimited* future of science and technology. Otherwise, progress can lead to alienation. Confirmation can be Mumford's (1934) thesis that arms technological advancement can affect human isolation from the *future's morality* as it made violent acts distinct from the human experience.⁸ Additional confirmation can be Vukotić's idea (2011) that moral-related risk is also the danger that individuals start thinking as computers meaning the lack of creativity, innovation, morality, compassion and cooperation culture. In addition, the ascent of security threats and their depth confirms Dixon's fraction times occurrence idea.

Globalization is conceptually steered to the networked individual rather than the collective. Individuals themselves should try to control technology's effects i.e. find technology's usage limitations by creating new security and techno-economic paradigms. Second, perhaps an even more important element of globalization is its openness which enables: (i) cultural exchange and (ii) consequentially, salvage from civilization's clash by creating one through previously stated.

The vision of security's future implies new paradigm(s) but also openness for its continuous (r) evolution due to the technoeconomic and societal changes (Jovetić, 2021). Two important questions rise: (i) Dixon's dilemma is whether the future manages us, or we manage it and (ii) can it be allowed that future (of security) be reproductive power of technology. Consequentially, both questions direct to a similar process i.e. the necessity of determining technological outcomes *limitations*. In the end, it seems that respective can only be achieved through different individual(s) security and technoeconomic paradigms based on morality, compassion, culture, different political thinking and utility based on prudence and sympathy.

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⁸ Especially long-range and unmanned weapons.

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A Predictive Maintenance Deployment Model for IoT Scenarios

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Abstract: *The Internet of Things (IoT) concept describes the intelligent connectivity of smart devices using Internet connectivity. In a continuously developing IoT environment, companies try different approaches for predictive maintenance as a solution to reduce costs and the frequency of maintenance activities. Such an environment can natively foster predictive maintenance as it integrates information from different equipment to derive insights and predictions.*

This paper proposes a deployment model for predictive maintenance approaches on industrial equipment by processing and analyzing their audio signals. Proper maintenance scheduling is necessary to prevent business costs and maintain the equipment in operational capability.

The authors propose a system architecture to make predictive maintenance applicable in different industrial scenarios. The implementation exploits deep learning neural networks to detect anomalies and further classify them into categories. These machine learning techniques enable predictions of equipment's conditions and thus maintenance services can be performed.

1. INTRODUCTION

Nowadays, the automation and digitalization of industrial production processes are standard in many companies (Liebetrau & Grollmisch, 2017). Liebetrau and Grollmisch explain that an aspect of this automation process is the timely and efficient handling of equipment failures. Considering this, industrial equipment maintenance is an essential process with an impact on the prospect of the businesses. Its primary purpose is to ensure that all the equipment, required for production, is operating at 100% efficiency at all times (Moblely, 2002). Maintenance is considered one of the most important facets of modern industry³. According to British Standard, 381⁴ maintenance is:

The combination of all technical and associated administrative actions to retain an item in, or restore it to a state in which it can perform its required function.

In this work, maintenance is interpreted within the context of industrial environments, with a particular focus on its technological point of view. Therefore, we elaborate about applying maintenance to industrial equipment in an IoT environment. Industrial equipment is a wide range of devices, built and designed to make manual labor faster and easier, in industrial production floors⁵. They handle different industrial processes, such as: production, measurement, components assembly, etc.

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³ www.paragon-u.com/the-importance-of-equipment-maintenance

⁴ www.bsigroup.com/en-GB

⁵ www.industrial101.com/equipment

Different categories of equipment maintenance philosophies are currently applied in the industry, including run-to-failure maintenance, preventive maintenance, proactive maintenance and predictive maintenance (Girdhar & Scheffer, 2004). Each approach has its advantages and disadvantages. The division of types of maintenance has the disadvantage that each piece of equipment needs a mix of each of the above-mentioned maintenance types, so we cannot think of applying a single one of them in equipment⁶.

2. PREDICTIVE MAINTENANCE

The focus of this paper is predictive maintenance, considering the benefits and its broad utilization in the industry. Predictive maintenance (PdM) aims to prevent machinery failure by predicting when failures occur and thus performing maintenance services. Its purpose is to periodically monitor and report the status and operational capacity of the equipment by knowing the values of certain parameters, which represent such states and operational ability (Girdhar & Scheffer, 2004).

Using the predictive maintenance technique requires the identification of the physical parameters (e.g. temperature, vibration, audio, etc.), and which state serves as a trigger for the need of the machine's maintenance. The proposed solution architecture monitors audio signals of the equipment components, thus it is an audio-based system for predictive maintenance.

Predictive maintenance's benefit is predicting machine failures before they occur (Mobley, 2002). This approach allows one to perform a maintenance service before an erroneous state causes the failure of the equipment. As a result, the offline time of the equipment is minimized, and maintenance financial costs are reduced.

According to Yoskovitz, "Predictive maintenance has been proven to be efficient in reducing maintenance costs by 30%, eliminating 75% of all failures and even reducing energy consumption by up to 20%"⁷. However, Yoskovitz further adds that only 12% of commercial facilities are using predictive maintenance in their production lines⁸. As a result, we should focus more effort on predictive maintenance to provide further solutions and make it more accessible in the industry.

3. RELATED WORK

Due to the rapid increase of complexity in engineering systems and the availability of condition monitoring data, predictive maintenance has gained a lot of attention in the last decade (Lee & Pan, 2017). Predictive maintenance approaches use different technologies such as vibration monitoring, thermography, visual inspection, ultrasonic and other testing techniques (Mobley, 2002). The usage of each approach depends on the industrial equipment's physical and technical features. The application of the same solution for different types of industrial equipment is not possible (Yul Oh & Yun, 2018).

One of the predictive maintenance technologies, elaborated by Liebetrau and Grollmisch, is sound analysis. On this premise, Liebetrau and Grollmisch define two approaches used for monitoring: structure-borne analysis and airborne analysis (i.e. airborne analysis is less common in

⁶ www.mantenimientopetroquimica.com/en/typesofmaintenance.html

⁷ www.newelectronics.co.uk/electronics-technology/making-ultrasound-based-predictive-maintenance-accessible/152769

⁸ Ibid.

real-world scenarios). On the one hand, structure-borne analysis measures the structural vibrations through the sensor mounted on the system under test (SUT). On the other hand, an airborne approach captures the radiated sound of the SUT using contactless microphone sensors (Liebetau & Grollmisch, 2017).

In addition, Liebetau and Grollmisch explain: the collected sound data are analyzed using different machine learning approaches such as Support Vector Machines (SVM), Gaussian Mixture Models (GMM) and Deep Neural Networks (DNN). In conclusion, acoustic condition monitoring via airborne sound analysis in conjunction with advanced signal processing and machine learning methods prove to be a powerful tool for early detection of machinery failures (Liebetau & Grollmisch, 2017).

Saimurugan and Ramprasad propose a combination of the vibration-based analysis with audio signals analysis. As a result, they achieve a higher classification efficiency with the fusion of the two features, compared to both the vibration and sound signal. Additionally, the usage of an artificial neural network performs better than other machine learning approaches. Finally, Saimurugan and Ramprasad observe that the vibration-based analysis gives more information than the audio features (Saimurugan & Ramprasad, 2017).

Zhu et al. propose an approach for sound events classification using convolutional neural networks (CNN) (Zhu et al., 2018). Their work puts the focus on audio data preprocessing (i.e. featurization) using the Fast Fourier Transform algorithm. According to Zhu et al., this process is required to make the data useful for the machine learning algorithm. The neural network architecture which they propose is very similar to the VGG network (Simonyan & Zisserman, 2014).

4. SYSTEM DESIGN

This section focuses on identifying the components of the system and establishing its architecture. In an industrial context, various types of sensors can be used. However, this solution focuses on audio sensors to monitor industrial equipment's conditions. The system consists of three components: *DataCollector*, *LearningExpert* and *PredictionExpert*. Figure 1 presents the UML component diagram which depicts the subsystem decomposition (Brügge & Dutoit, 2009).

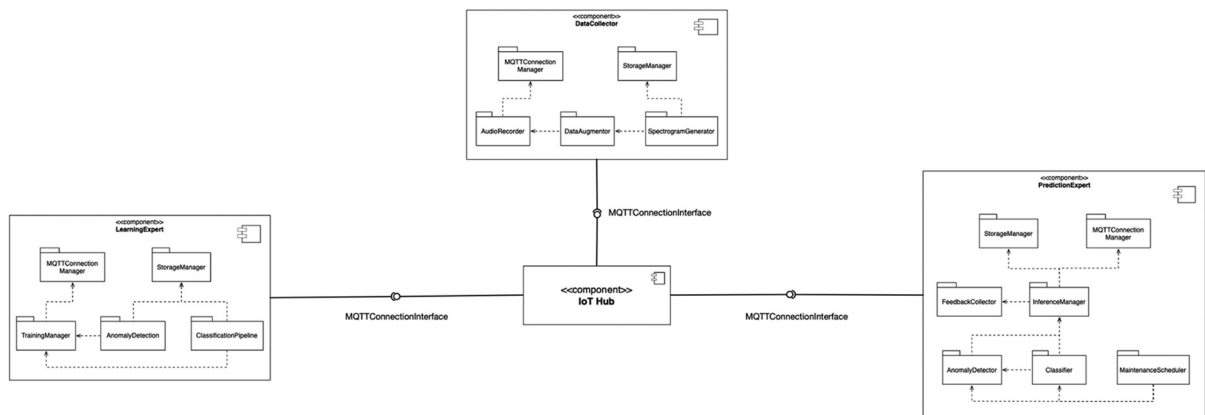


Figure 1. AudioForesight Subsystem Decomposition (UML Component Diagram)

The solution uses a broker architectural pattern to facilitate the communication between its components. The usage of such a pattern ensures the modularity of the components (i.e. thus

low coupling), as their communication mechanism is decoupled from the implementation. Additionally, the broker pattern enables location transparency because the components do not need to know the location of each other, but they use the broker as a "man-in-the-middle", to transmit messages to other components. Furthermore, considering the decoupling of components, it is easier to add, remove or change them at runtime. Finally, since the subsystems do not directly interact with each other, we achieve platform independence (i.e. components can be implemented with different programming languages).

In this solution, this architectural pattern exploits the MQTT protocol to exchange topic-based messages. However, it is important to emphasize that other protocols can be used instead of MQTT and this is only a design decision for the system.

4.1. Data Collector

The *DataCollector* component serves for collecting audio recordings and preparing them for analysis. Firstly, it opens the audio stream and writes the audio frames into WAV⁹ files. Secondly, the *DataCollector* preprocesses the audio recording files and extracts their spectrogram representation. Finally, it uploads the generated audio spectrograms to the cloud storage. The *DataCollector* consists of five packages, discussed in the following.

- **AudioRecorder:** takes care of the audio recording process.
- **DataAugmentor:** recorded audio files go through several augmentation steps in order to generate noise in the dataset and increase its size.
- **SpectrogramGenerator:** hosts the logic to calculate the frequency spectrum from the amplitude representation of raw audio signals.
- **ClientConnectionManager:** client which publishes/subscribes to an IoT broker.
- **StorageManager:** establishes the *DataCollector*'s connection to the cloud storage and uploads the generated audio spectrograms in the respective storage components.

4.2. Learning Expert

The *LearningExpert* component conducts the process of audio data analysis. It focuses on understanding relationships in the audio signal features which serve to build the trained models. The *LearningExpert* component establishes the knowledge which is used for the prediction phase and maintenance schedule.

- **TrainingManager:** responsible for the training process management.
- **AnomalyDetection:** exploits an autoencoder neural network to provide a residual error-based anomaly detection pipeline.
- **ClassificationPipeline:** trains the classification model.
- **ClientConnectionManager:** responsible for handling the connection and the messaging infrastructure logic.
- **StorageManager:** controls the *LearningExpert*'s connection to the cloud storage, thus enabling it to download audio spectrograms and upload trained models in the corresponding storage components.

⁹ See www.blogs.msdn.microsoft.com/dawate/2009/06/23/intro-to-audio-programming-part-2-demystifying-the-wav-format

4.3. Prediction Expert

The *PredictionExpert* component exploits the knowledge stored in the *LearningExpert*'s trained models to make predictions on unseen data. This component analyzes audio recordings to detect anomalies and classify them into categories. Additionally, its features include scheduling maintenance services, based on the prediction results in combination with expert knowledge.

- **InferenceManager:** supervises the inference process. First, the *AnomalyDetector* package analyzes the audio data to check for anomalies. Second, only if an anomaly is detected, the *Classifier* package provides predictions about the anomaly's classification. Third, based on the anomaly score from *AnomalyDetector* and the classified category from the *Classifier*, maintenance service is performed.
- **AnomalyDetector:** uses *AnomalyDetection*'s model to detect anomalies on new recordings.
- **Classifier:** uses the *ClassificationPipeline*'s trained model to distribute new recordings into known categories.
- **MaintenanceScheduler:** exploits predictions from the *AnomalyDetector* and *Classifier* to determine the needs for maintenance services.
- **FeedbackCollector:** hosts the logic of retrieving industrial equipment operator's feedback and injecting it during the prediction process.
- **ClientConnectionManager:** allows the *PredictionExpert* to interact with the IoT broker.
- **StorageManager:** facilitates the *PredictionExpert*'s connection to the cloud storage.

5. FOG COMPUTING ARCHITECTURE

Fog computing is a distributed paradigm that provides cloud-like services to the network edge (Dastjerdi & Buyya, 2016). According to Dastjerdi and Buyya, the technology deals with IoT data locally by edge devices near users, to carry out a substantial amount of storage, communication, control, configuration, and management (Dastjerdi & Buyya, 2016). The approach benefits from edge devices' proximity to sensors while leveraging the on-demand scalability of cloud resources. Such a concept adapts well to the solution domain of AudioForesight system. In this context, AudioForesight contains one or more audio sensors (i.e. one sensor for each drive) attached to industrial equipment. The above-described architecture suggests that the *EquipmentController* machine collects and processes the audio data. As a result, this machine is a single point, which handles the preprocessing of all sensor data. Thus, a single machine uses a considerable amount of computational power.

To relieve the *EquipmentController* machine from the workload, we can use a fog architecture between the edge devices (i.e. the audio sensors) and the cloud infrastructure which further analyzes the data and makes predictions. In Figure 2, we present the UML deployment diagram, which embeds the fog infrastructure concept. In this case, each sensor attached to the industrial equipment connects to a microcontroller chip (e.g. a RaspberryPi device) which hosts the *DataCollector* component. As a result, each edge device (i.e. RaspberryPi) individually executes the collection and preprocessing of the sensor data.

Thus, we alleviate the *EquipmentController* machine from the pre-processing operation and it only takes care of retrieving the data from edge devices and forwarding them to the cloud infrastructure. Such architecture makes it easy to scale the system with new monitored physical parameters, as each sensor has its individual pre-processing unit which is decoupled from other sensors.

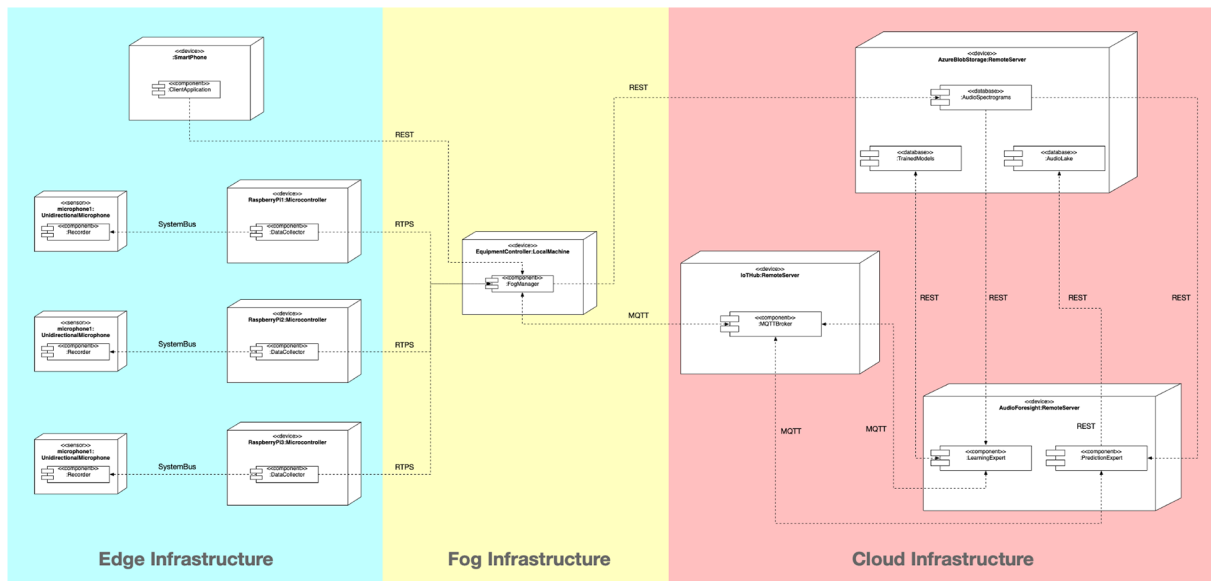


Figure 2. Architecture Extended With Fog Computing (UML Deployment Diagram)

6. CONCLUSION

This paper introduced AudioForesight, an audio-based approach for predictive maintenance in IoT environments. This solution allows for the prediction of the need for maintenance services based on the monitoring of operational conditions of industrial equipment. Furthermore, AudioForesight establishes a system architecture that is adaptable to different industrial application domains and types of sensors.

Compared to other approaches which focus specifically on designing and implementing machine learning solutions to deal with predictive maintenance, AudioForesight suggests a system architecture by exploiting several machine learning approaches. While the focus on a single machine learning solution enables it to be more specific with the prediction results and probably even more accurate, using a solution such as AudioForesight has the advantage of providing a broader picture of the industrial equipment conditions and thus more reliable decisions.

AudioForesight is a ready-to-use system and it can be easily deployed on various platforms. We encapsulated its components into Docker containers which make the deployment procedure quick and with little effort required. Since the system hosts online the communication and storage infrastructures, the deployed components need network connectivity to interact. Once the system is successfully deployed at industrial equipment it is available for operation.

7. FUTURE RESEARCH DIRECTIONS

7.1. Adding Other Sensor Types

Extending the system's architecture with new types of sensors is part of future work. Several alternative types of sensors can be included in the system to improve its predictive maintenance mechanism. Having a broader physical parameter coverage allows for building a more accurate and reliable solution. If we use more sensors, the decision-making regarding maintenance performs analyzes more parameters and thus predictions are more accurate. As a result, we enhance the predictive maintenance approach of AudioForesight.

7.2. Implementing Client Application Interfaces

AudioForesight uses a command line interface to interact with external users. Such a solution facilitates the usage of the system, however, is not very satisfying for the users. To improve the system's usability, the implementation of better client applications is necessary.

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Reviewing Applications of the Non-parametric DEA Methodology in Croatia

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Non-parametric method;
Review



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Abstract: This article surveys and presents the applications of Data Envelopment Analysis (DEA) in Croatia, i.e. in different industries and economic sectors in Croatia. The systematic review followed the PRISMA statement and guidelines for systematic literature review. The main scientific online databases were accessed in September 2022 without time constraints with the use of the keywords „DATA ENVELOPMENT ANALYSIS“ and „CROATIA“. Therefore, all the applications of DEA in Croatia are presented ever since the introduction of DEA back in 1978. This review's main goal is to gain insights into the areas of research in Croatia that most commonly use the DEA methodology and the areas that neglect this methodology. Moreover, the Croatian authors that most commonly use this methodology will be revealed. Another goal is to introduce all the various aspects of efficiency evaluation that can be used with the DEA methodology. The ultimate goal of this paper is to increase awareness among academic members, scholars and analysts to employ the DEA methodology more often when it comes to measuring the relative efficiency of homogeneous decision-making units (DMUs). The paper concludes with a summary of the DEA applications as well as literature gaps on DEA applications in Croatia. Moreover, suggestions and guidelines for future research are provided.

1. INTRODUCTION

The Data Envelopment Analysis (DEA) has been introduced in 1978 and „the first DEA-related paper co-authored by a Croatian author was Charnes and Neralić (1987)“ (Neralić & Gardijan Kedžo, 2019). It has ever since gained large popularity among researchers, scholars and practitioners. Data Envelopment Analysis is a data-oriented approach for evaluating the performance and relative efficiency of a set of units called decision-making units (DMUs), which use multiple input and output variables in the evaluation.

The main objective of this study is to provide new insights into the areas of research in Croatia that most commonly use the DEA methodology and the areas that neglect this methodology. Furthermore, the Croatian authors that most commonly use this methodology will be revealed. Notwithstanding, the introduction of all the various aspects of efficiency evaluation that can be used with the DEA methodology is another objective.

To achieve these goals, a systematic literature review following the PRISMA statement and guidelines for systematic literature review was conducted. Namely, the identification and survey of papers employing DEA regarding Croatia were initiated with the survey of three relevant scientific bases with the keywords „DATA ENVELOPMENT ANALYSIS“ and „CROATIA“.

The key findings of this review would shed light on very interesting issues that need to be addressed, as well as on many industries that do not make use of the DEA applications.

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Moreover, this study would inspire other scholars and practitioners to employ the DEA in their research regularly.

The rest of this paper is structured as follows. In the second section, a short theoretical background on the Data Envelopment analysis is given. Section 3 covers the research methodology and Section 4 reveals the results of this study. The last and fifth section contains a discussion regarding the most interesting findings and concluding remarks.

2. THEORETICAL BACKGROUND ON DATA ENVELOPMENT ANALYSIS (DEA)

The Data Envelopment Analysis (DEA hereafter) has been first introduced in the seminal paper of [Charnes et al. \(1978\)](#), and it was based on the concept of technical efficiency developed by [Farrell \(1957\)](#). DEA has “instantly been recognized as a useful methodology for measuring the relative efficiency of different entities, called Decision Making Units (DMUs), given multiple criteria” ([Neralić & Gardijan Kedžo, 2019](#)).

It is a mathematical programming technique that allows determining whether each of the analyzed entities, based on data on its inputs and outputs, is relatively efficient or not, relative to the other peer DMUs included in the analysis ([Cvetkoska, 2010](#)). The definition of decision-making units (DMUs) is quite flexible because, in the last few decades, the DEA methodology has been used to determine the performance of different entities operating in different industries. Moreover, the DEA methodology enables an understanding of how each unit (DMU) works in relation to the other units included in the efficiency analysis, thus revealing the sources and levels of inefficiency for each input and output and how a DMU can improve its operation to become efficient. In this sense, DEA calculates the relative efficiencies of each unit concerning the others, using the determined values of the inputs and outputs of each unit, given the fact that it allows ranking between the units in the sample. Therefore, DEA has a lot of advantages that make it widely applied ([Naumovska & Cvetkoska, 2014](#)).

The DEA methodology has two basic models, namely: the CCR model (which got its name from the first letters of the authors' surnames Charnes, Cooper, Rhodes, 1978) and the BCC model (after Banker, Charnes and Cooper, 1984). The main distinction between these two models is the way they treat returns to scale, i.e. ranking. While the BCC model allows variable returns to rank – the VRS (variable returns-to-scale) assumption, the CCR model assumes that each homogeneous DMU operates with constant returns to the rank/scale used CRS (constant returns-to-scale), which means that all firms operate at their optimum. Since the CCR model was introduced, it has been criticized due to the CRS assumption and therefore [Banker et al. \(1984\)](#) extended the CRS model to take probability into account from variable returns to rank (VRS) and introduced the BCC model.

The results obtained from DEA classify the units as efficient and inefficient. Efficient Units (DMUs) are those best practice units that have an efficiency score of 100%, while other banks score between 0-100 per cent.

3. RESEARCH METHODOLOGY

The methodology used in this study is the PRISMA-compliant systematic literature review (SLR), with a meta-analysis of the findings. The PRISMA (Preferred Reporting Items for Systematic Reviews and Meta-Analyses) guidelines have been first introduced in 2009 „to help

systematic reviewers transparently report why the review was done, what the authors did, and what they found” and have been revised and updated in 2020 (Page et al., 2021).

The first step of the research approach was to set the search strategy and to identify and select the scientific databases that should be surveyed for this study. Considering the reputation and global recognition of the Web of Science and Scopus databases, the author consulted both of these global scientific databases. However, since this study revolves around DEA applications in the Republic of Croatia, it has been logical and obvious that the CROSB (Croatian Scientific Bibliography) had to be consulted as well.

In the second step, the identification of relevant studies in these three databases occurred, with the use of the keywords/keyphrases „DATA ENVELOPMENT ANALYSIS“ and „CROATIA“. This resulted in 154 articles in the WoS database, 52 articles in the Scopus database and 47 articles in the CROSB database, i.e. a total of 253 articles. Thereafter, the refined search by selected categories and with the abstract and full-text screening occurred. In this step, the necessary substep was to identify and exclude the duplicate articles (i.e. articles that are indexed in more than one of these databases, which were 44 articles). The abstract and full-text screening (i.e. the application of the inclusion and exclusion criteria) resulted in the exclusion of another 23 articles, thus bringing this review to a total of 186 articles that employ DEA regarding Croatia. This research and selection process has been graphically presented in Figure 1.

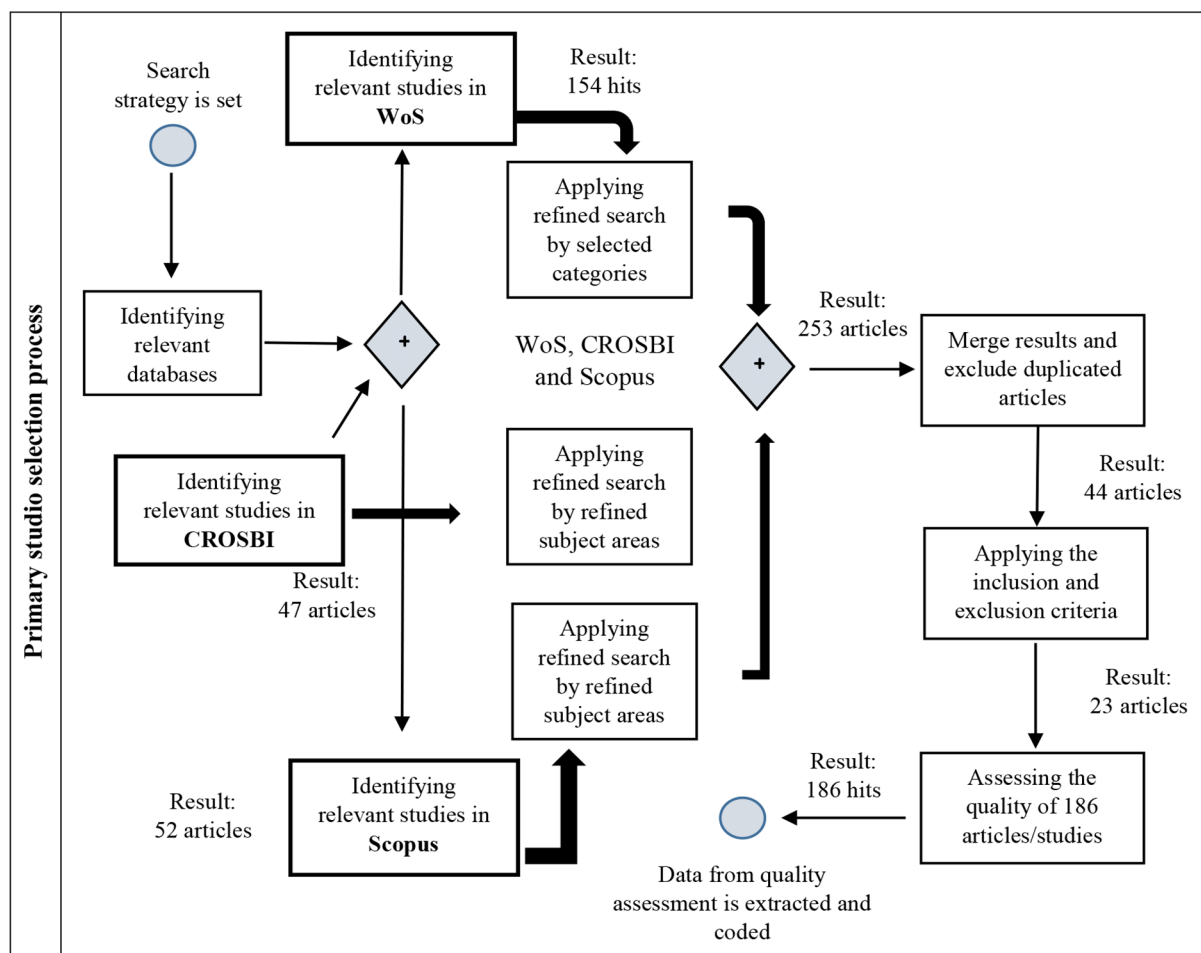


Figure 1. The selection process of relevant studies for the literature review

Source: Author's work

4. RESULTS

The analysis that was primarily conducted was the number of papers published throughout the years. Therefore, in Figure 2, the number of papers published by year is graphically presented. In the period from 1999 to 2011, the number of published papers regarding Croatia with the application of DEA was rather modest. Thereafter, the number of published papers dramatically rises to 30 published papers in 2019. It can be concluded that the number of published papers has risen dramatically since 2016 and has remained relatively high ever since (with a small decline in COVID-19 2020).

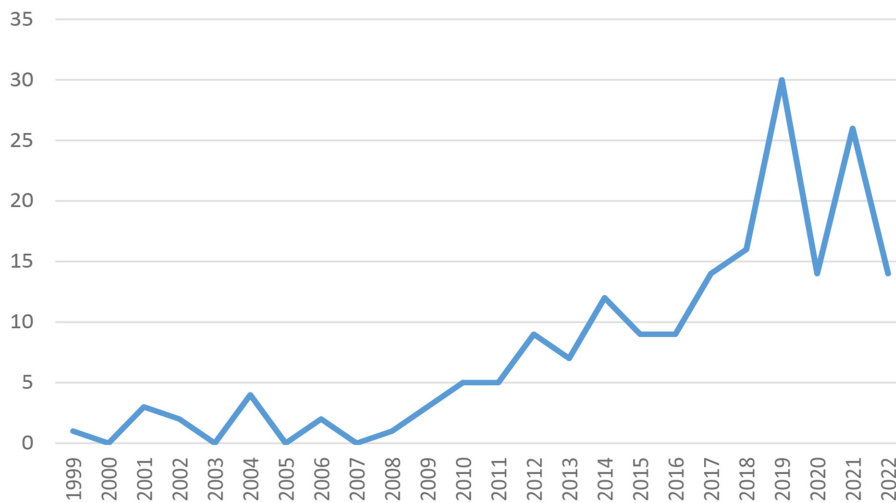


Figure 2. The number of DEA-related publications in Croatia (1999 – Nov. 2022)

Source: Author's work

Most of the DEA applications in Croatia are consistent with previous findings of [Emrouznejad et al. \(2008\)](#), who found the following areas to be mostly researched areas when applying the DEA methodology: “banking, education, healthcare and hospital efficiency” and with [Emrouznejad & Yang \(2018\)](#), who found that „DEA is mostly used in the banking industry, along with the supply chain, public sector, agriculture and transportation industry “. Moreover, the findings from this study show that banking, public sector and macro-efficiency are mostly researched when applying the DEA methodology regarding the Republic of Croatia. Transportation and energy follow each area with 14 papers, followed by the evaluation of regional efficiency in Croatia with 13 empirical studies and so on, as shown in Table 1.

Table 1. Research areas in Croatia with the most DEA applications

Banking	22
Public sector (public hospitals, administration...)	22
Macro-efficiency (comparison of Croatia and other countries)	22
Transport	14
Energy	14
Regional efficiency	13
DEA theory	12
Tourism	10
Education	8
Insurance	7
Agriculture	4
R&D	4
Sustainability	4

Source: Author's work

There is a lack of empirical studies employing DEA in the supply chain and agriculture in Croatia.

As for the Croatian authors with most DEA applications, an in-detail screening of the authors occurred, resulting in the findings in Table 2. Rabar is the most contributing author regarding the application of DEA in Croatia with 22 published papers in the three surveyed databases and authors Šegota (13 papers), Gardijan Kedžo (12 papers), Neralić (12 papers) and Fotova Čiković (12 papers) follow.

Table 2. Authors with most DEA applications regarding Croatia

Top contributing authors	Number of published papers
Rabar, D.	22
Šegota, A.	13
Gardijan Kedžo, M.	12
Neralić, L.	12
Fotova Čiković, K.	12
Škrinjarić, T.	9
Lozić, J.	9
Borozan, D.	7
Kordić, L.	7
Hodžić, S.	7
Šporčić, M.	6
Mihelja Žaja, M.	5
Tuškan, B.	4
Lukač, Z.	3
Boljunčić, V.	3
Mihaljevic Kosor, M.	3

Source: Author's work

5. DISCUSSION AND CONCLUSION

This extensive literature review has revealed many new insights regarding the application of DEA in Croatia. Namely, the number of published papers has been modest up until 2016, and the year with the most published DEA papers regarding Croatia is 2019. Banking, public sector (public hospitals, administration...) and macro-efficiency (comparisons of Croatia and other countries) are the research areas that mostly apply the DEA in Croatia, whereas researchers in supply chain and agriculture in Croatia have neglected the DEA methodology. The top contributing author of papers employing DEA in Croatia is Rabar (with 22 published papers), followed by Šegota (13 papers), Gardijan Kedžo (12 papers), Neralić (12 papers) and Fotova Čiković (12 papers).

In this study, the author has surveyed the two most renowned scientific databases globally, i.e. the Clarivate Web of Science and the Scopus database. However, considering the research subject that includes Croatia, the research would have been incomplete if the Croatian scientific bibliography had not been consulted and surveyed. The extensive study included 186 relevant papers that apply DEA methodology in different industries in Croatia. The findings from this research would contribute greatly to many scholars and practitioners.

This systematic review, however, does have its limitations. Namely, this review surveys three scientific databases (i.e. the Clarivate Web of Science, the Scopus and the CROSB database) for

relevant papers. To the best of the author's knowledge, there are no other relevant papers published regarding DEA in Croatia. However, there is a possibility that relevant papers have been published and indexed in other scientific databases and have not been included in this review. Secondly, this is not a novel study. Namely, the motivation and inspiration for this work were aroused by the paper of **Neralić & Gardijan Kedžo (2019)**, and a continuation of their efforts including the years after their paper was published (i.e. 2019 - 2022) has been included. And lastly, a bibliometric study is suggested and is a guideline for future work, since the text mining technique and the word cloud could reveal interesting new insights regarding the application of DEA in Croatia. In future work, a more intermediate and extensive bibliometric literature review regarding the use of DEA in Europe will be conducted.

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Science and Technology Parks and Their Role in the Economic Development of the Republic of Serbia

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Abstract: *In a large number of countries, both developed and developing countries, science and technology parks are considered an important mechanism for improving and encouraging the development of industry, as well as the economy as a whole, because they encourage the development of SMEs, which use modern (high) technology, which at the same time affects accelerated economic development based on knowledge. The basic task of all forms of science and technology parks is the development and promotion of innovative activities, the appearance of as many innovations as possible on the market (domestic and international) and assistance in the commercialization of the results of scientific research. The goal of the work is to indicate that the construction and development of science and technology parks should enable the improvement of the competitiveness of the Republic of Serbia, more intensive economic and development as a whole, faster development of innovative SMEs and increased volume of foreign direct investments. Bearing in mind that there is an uneven distribution of science and technology parks and that in the development of science and technology parks, the Republic of Serbia lags behind the countries of the European Union, as well as some countries in the surrounding area, it is necessary for the coming period to equip them with all the necessary infrastructure, which will enable companies, scientists to engage in scientific research and project development, as well as to be connected with faculties, other innovative companies and local self-government units.*

1. INTRODUCTION

The modern stage of economic development takes place in conditions characterized by increasingly fierce competition between companies on the market, intensive technological development, increasing customer demands regarding product quality, demands and pressures for the protection and preservation of the human environment, etc. Successful business and survival in such conditions impose the need for small and medium-sized enterprises, in a certain area, to connect through certain forms of business infrastructure, namely: industrial clusters, and business incubators, as well as by establishing industrial and free zones and science and technology parks, which become increasingly popular (Gligorijević, 2021). At the same time, the increasing connection of science and, above all, industry, as well as the increasingly rapid and intensive development of science, technique and technology, especially influenced the emergence and accelerated development of science and technology parks, which are of crucial importance for the economic development of a country because they encourage the development of innovative small and medium-sized enterprises that use modern techniques and technology and that, at the same time, influence faster economic development based on knowledge. In addition, with their help, investors can obtain the necessary permits for the construction of business premises in which they will carry out industrial production, as well as other numerous scientific research and innovation activities, much more easily.

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Science and technology parks are certainly one of the key elements of business infrastructure, considering that they represent a communally equipped space that provides the necessary infrastructure to companies dealing with advanced technologies, software design, electronics production, and the like (Mijačić, 2011, p. 35). The goal of science and technology parks is that, first of all, small and medium-sized enterprises, which are interested in this type of work, are under the same roof, are gathered in the same location and encourage each other in the process of co-operation, and therefore development technique, technology, innovation and entrepreneurship.

The representation of science and technology parks in the Republic of Serbia is gradually increasing, that is, it tends to further growth and development. The Law on Innovation Activities lists the services that science and technology parks can provide, which are increasing over time: use of business space for work and infrastructure support, use of common business premises, legal-administrative services, secretarial services, bookkeeping and accounting services, services marketing, promotion and sales, business and individual consulting services, telecommunications and information services, access to equipment for applied scientific and research work, providing support in prototyping, testing projects in a real environment, business planning services, financial consulting services, training and coaching services, financial services and technical and many other services (Official Gazette of RS, no. 110/2005, 18/2010 and 55/2013). It should be emphasized that for the development and improvement of science and technology parks, as well as free zones, the issue of optimizing their activities and actions at the regional and local level is particularly important (Pace, 2000, p. 1).

2. SCIENCE AND TECHNOLOGY PARKS (STP) AS AN ELEMENT OF BUSINESS INFRASTRUCTURE – PHASES, OBJECTIVES AND ADVANTAGES OF ESTABLISHING A STP

The development of science and technology parks began in the 50s of the 20th century, and they experienced their full expansion in the 70s and 80s of the 20th century. The first science and technology park (STP) was founded in the 1950s at Stanford University in the USA. In Europe, science parks appeared during the early 70s of the 20th century. The winners were Heriot-Watt University Research Park and Trinity College Cambridge, Science Park in Great Britain, Louvain-la-Neuve in Belgium and Sophia Antipolis and ZIRST Grenoble in France. They followed examples from the USA and based their activity mainly on renting land to one owner (Žuvela, 1993). Their emergence and rapid expansion were conditioned by the scientific and technological revolution and with it the need to connect science and industry. To date, several organizational forms of technology parks have been developed. The main task of all of them is to support innovative activities and commercialize the results of scientific research (Brunsko, 1995, p. 321).

Science and technology parks occupy a part of the country that is configured to promote the economic activities of integrated firms, infrastructure and amenities that support technology-intensive production and commercialization in innovative enterprises, start-ups, research institutes and universities (Bellavista & Sanz, 2009).

Science and technology parks are extremely popular today, and this stems from the fact that their establishment provides various benefits for both the local self-government and the entire region. They contribute to industrial and economic development and are very important, both for highly developed countries and for developing countries, such as the Republic of Serbia. However, one must take into account the fact that the science and technology park is significant, but not

sufficient, as the only instrument for attracting foreign investors and new interested companies. On the contrary, without a legal framework that ensures a favorable business climate and without an appropriate and high-quality workforce, as well as infrastructure, investing in a science and technology park is considered futile and without the benefit (Kostadinović, 2016, p. 138).

In the process of establishing science and technology parks, there are several important stages, namely:

- The first phase includes making a decision – namely the decision of the local self-government to invest in the construction of a new science and technology park. It must be based on previous research on the need to establish a science and technology park. The business environment, as well as the physical environment, is examined and researched, and the demographic and economic structure is analyzed. If, after adequate research, it is established that there is a need and that such a decision will lead to concrete results, the construction of the park is approached and it is decided which type of science and technology park will be dominant.
- Phase two includes the formation of a working group for the establishment of a science and technology park – the president of the municipality appoints a team of experts from various fields, and the team must also have all the necessary skills and knowledge to be able to participate in the establishment of the park.
- Phase three includes a feasibility study (market and financial analysis). It is necessary to examine in detail the location where the construction of the science and technology park is planned. In the same way, an analysis of the environment is necessary, as well as an analysis of the market, which will show us what the infrastructure of society is like, the supply of labor, the demand for industrial facilities, etc. In addition to the aforementioned analyses, the financial analysis is no less important, which certainly shows us how profitable the construction of the park is.
- Stage four – location assessment – in most cases, the success of a science and technology park depends on a properly chosen location. The choice of location is largely influenced by factors such as the possibility of a good, reliable and adequate supply of electricity, gas and heating, water; proximity and accessibility to airports, railways and main roads; the possibility of processing wastewater, etc. Environmental factors are also very important, which actually means that the goal is to choose a location that will reduce the harmful impact on the environment.
- Phase five is related to the management of the science and technology park. Namely, the park can be managed in two ways: management through a domestic company or a foreign company, which is the owner or lessee of the land, and the park can be managed by the head of KLER (Office for Local Economic Development) with the help of the Directorate for Construction and Public utility companies (JKP), the Department for Property and Legal Affairs and the Department for Urban Planning.
- Phase six – securing the land and/or pre-contracting with private owners and/or contracting with private investors – the land intended for the science and technology park can be owned by the local self-government or private owners.
- Phase seven – preparation of the project for infrastructural equipment of the science and technology park – after providing an adequate location, it is necessary to carry out the infrastructural equipment of the park itself.
- Phase eight – construction of infrastructure in the science and technology park – this phase is perhaps one of the most important in the process of establishing a science and technology park. Phase nine refers to the marketing and promotion of the science and technology park, which are of great importance in the process of attracting direct foreign investment.

Science and technology parks are drivers of technological changes that encourage new investments and provide support to newly established small and medium-sized enterprises, reducing unemployment and increasing the standard of living, thus influencing the development of the region in which they are established. Therefore, the construction of such parks is of strategic importance for the development of the country, both economically and overall.

The key to the success of science and technology parks is the provision of non-monetary values related to research and development (proximity to a university or a large research laboratory, the presence of large organizations or the concentration of other local activities related to research and development) and the availability of business services that promote the development of companies in the role of the client of the science and technology park (European Commission, 2013, p. 41).

The positive results of science and technology parks are reflected in the successful attraction of foreign direct investments and investments in production capacities, especially in developing countries. Speed and success in the development of parks can significantly increase the probability of attracting foreign direct investments to the Republic of Serbia.

As for the goals, the most important goals of the establishment of science and technology parks are: a) creation of favorable conditions for the acceleration of science and technology development in the most developed and advanced scientific research branches of production with the help of the most successful commercialization of scientific research, based on mutual connections between science and industry; b) Acceleration of the process of restructuring the industry and the entire economy, which is achieved by the modernization of traditional industrial branches, the constant introduction of innovations, the spread of high technologies and the creation of new industrial branches; c) acceleration of economic and social development of the region, activation and better use of local natural, intellectual and financial resources, creation of regional, scientific, transport and communication infrastructure and inclusion of the region in the national economy, world market and international scientific, technological and business standards; d) activation of entrepreneurial spirit and initiative, greater openness of business relations of companies with their domestic and foreign partners, as well as with scientific and educational institutions, and raising business culture and ethics to a higher level. In addition to the stated goals, the main goals of establishing science and technology parks are also highlighted: a) introduction of new production activities; b) the construction of business-residential infrastructure is an extremely important goal in the process of formation, but also the further development of science and technology parks; c) building the infrastructure of modern companies and their entry into the science and technology park; d) creating a favorable business environment with better communication between institutions of higher education (Žuvela, 1993, p. 107).

3. SCIENCE AND TECHNOLOGY PARKS IN THE FUNCTION OF ECONOMIC DEVELOPMENT OF THE REPUBLIC OF SERBIA

In modern conditions of development, science and technology parks are increasingly popular in the countries of Southeast Europe and developing countries. In the Republic of Serbia, this instrument of business infrastructure is increasingly represented and has a tendency for further growth and development. Although there is no explicit legal framework that defines business infrastructure, certain elements of business infrastructure are regulated at the level of the Law. Thus, the Law on Innovation Activity is related to science and technology parks. This Law

foresees the following services that can be provided by business and technology incubators and science and technology parks: use of business space for work, which can be equipped with furniture, equipment and installations; use of common business premises used for business meetings and other purposes; secretarial services; administrative services; bookkeeping and accounting services; advertising and sales services; business consulting services; telecommunication and information services; business planning services; financial advisory services; training and training services; financial services and technical and other services (**Official Gazette of RS No. 110/2005, 18/2010**).

The cities of Belgrade, Niš, Novi Sad, and Kragujevac have the greatest opportunities for the development of science and technology parks, bearing in mind that they represent the largest industrial and university centers, with the largest number of inhabitants and the largest number of educated personnel in the Republic of Serbia. The scientific institutes "Mihajlo Pupin" and "Vinča" also have great opportunities for the development of science and technology parks. In addition, in the area of the metal processing industry, the greatest opportunities for the development of science and technology parks are in Čačak, Kraljevo and Kruševac; Pirot and Leskovac in the area of the textile industry, and Vranje in the area of the wood industry and furniture production. Currently, the following science and technology parks exist in the Republic of Serbia: NTP Belgrade, NTP Čačak, NTP Niš, NTP Zvezdara, NTP University of Novi Sad, Technology Park Kragujevac (under construction), NTP Zemun.

Table 1. Science and technology parks in the Republic of Serbia

№	Science and technology parks	Basic characteristics
1.	Belgrade Science and Technology Park	<ul style="list-style-type: none"> - founded in 2015 (from 2015 to the end of 2022, it supported the accelerated development of more than 150 companies) - founded in partnership with the Government of the Republic of Serbia, the City of Belgrade and the University of Belgrade, with the support of the Government of Switzerland, - provides support to start-ups and growing companies in the development and commercialization of innovative products and services, - companies that are members of NTP Belgrade develop over 130 innovative products and services, export to over 50 countries around the world and employ over 1500 employees, - member companies have a visionary view of their environment, create a new economic climate, and generate a young qualified, creative workforce - 25 new start-up companies in 2022 - great success during 2022 – transition to a market strategy, entering the global market and access to VC funds.
2.	Science and Technology Park Čačak	<ul style="list-style-type: none"> - founded in 2011; in 2019 the NTP Start-up Center was equipped, in 2020 – opening of new production and office spaces, - enables the cooperation of the economy, science and research, the development of new ideas and the application of innovative solutions, create conditions for the development of entrepreneurship, - provides: education for the needs of innovative entrepreneurship, support for innovation and the establishment of innovative companies, start-up center services, logistical and technical support, - enables cooperation between science and business in the area of Western Serbia, - In 2022, a Demo Day was organized on the occasion of the implementation of professional workshops "Application of robotics in the improvement of production processes and products" for small and medium-sized enterprises from the area of Central and Western Serbia.

3.	Science and technology park Nis	<ul style="list-style-type: none"> - founded in partnership with the Government of the Republic of Serbia, the City of Niš and the University of Niš, it opened in 2020, - represents an organization that, in cooperation with the University, as well as the academic community, provides the necessary infrastructure, support, assistance and services to innovative companies in achieving business results and success on the market, especially in the field of high technology, - provides full administrative and legal support to newly founded start-up companies, - represents an important regional center for the dynamic development of innovative scientific and technological entrepreneurship and generally provides the necessary basis for reengineering the region's economy, as well as strengthening its global competitiveness, - provides infrastructural support to innovation activity.
4.	Science and Technology Park Novi Sad	<ul style="list-style-type: none"> - founded in 2020 by the Autonomous Province of Vojvodina, - has 31 members, two of which are scientific research institutes – the Institute for Artificial Intelligence and Biosens, 11 technological development companies and 18 start-up companies, and over 1000 highly educated experts, - provides infrastructural and professional services to its members – high-tech and medium-tech companies, innovation organizations, scientific research and higher education institutions, to apply and develop new technologies as quickly as possible, as well as for the creation and breeding of new products and services on the market, - cooperation with the University of Novi Sad

Source: Authors based on [Belgrade Science and Technology Park, 2022](#); [Science and Technology Park Čačak, 2022](#); [Science and technology park Nis, 2022](#); [Science and Technology Park Novi Sad, 2022](#)

In addition to science and technology parks in Belgrade, Niš, Novi Sad and Čačak, the plan is to build a science and technology park in Kragujevac. The construction of this park is planned in Sobovica, and the Government of the Republic of Serbia allocated 12 million euros for its construction. The goal of building this science and technology park is to connect the University of Kragujevac with the economy. There is an idea to unite science and economy in one place through NTP. The construction of this park will certainly affect the development of scientific and research work in the field of natural sciences, electrical engineering, mechanical engineering, chemical analysis and other fields related to natural and technical-technological sciences.

When it comes to the business of science and technology parks in the Republic of Serbia, it should be emphasized that large, developed companies and small start-up companies successfully cooperate within them and that this cooperation successfully contributes to common development. Science and technology parks in the Republic of Serbia help innovative start-up companies, while young entrepreneurs within the NTP Belgrade already create some innovations that are known all over the world (such as the Smart bench of the company Strawberry Energy, which provides energy for charging phones, tablets, etc. using only solar energy) ([Kostadinovic, 2016, p. 281](#)).

4. CONCLUSION

The development of science and technology parks is of crucial importance for the survival and development of modern industry and the economy as a whole. Namely, the incentives they give to the development of small and medium-sized enterprises, along with the use of modern technologies, simultaneously influence the development of the economy, which is additionally accelerated by basing progress on knowledge obtained from scientific research.

Science and technology parks should be seen as an organization for providing infrastructural support to innovation activity, which within the space entrusted to management provides infrastructural and professional services to companies, scientific research and innovation organizations in order to connect them and as quickly as possible apply new technologies, create and place on the market new products and services, with the aim of accelerated technological development of the country, based on examples of good international practice in this area.

Generally speaking, the main and basic task of all science and technology parks is to promote innovative activities, influence the appearance of as many innovations as possible on the market and help commercialize the results of scientific research (research work). Namely, parks, like incubators, are the most effective means of commercializing the aforementioned results, as well as the path to more efficient and faster restructuring of the industry, reduction of unemployment, more efficient use and further development of intellectual potential, as well as faster regional development.

Science and technology parks are also very important for the survival and development of modern industry. Their development is of essential importance for the entire economy, because they encourage the development of SMEs, which use modern (high) technology, which simultaneously affects the accelerated economic development based on knowledge.

Science and technology parks achieve impressive results, in addition to direct effects on the development of companies that cooperate within them, they also have direct effects on the entire social community, through the creation of new jobs, an increase in the population's income, an increase in tax income for local self-government, etc. They have been very relevant in the last few years, both in developed and less developed countries, and the purpose of their establishment is to connect science and the economy, all to increase regional competitiveness and create innovations. However, despite the excellent results, measures are needed to improve the development and operation of science and technology parks; namely, the legal framework is of essential importance, because without it, investment in a science and technology park is considered useless.

In the Republic of Serbia, there is an uneven distribution of business infrastructure elements. Namely, the business infrastructure is more significantly concentrated in five large cities of Serbia: Belgrade, Novi Sad, Niš, Subotica and Kragujevac. Among the many reasons for the concentration in these cities, we can mention the presence of donor programs and regional or SME development agencies that together contributed to the spread of awareness and ideas about the need for business infrastructure development. At the regional level, there is a significant difference in the concentration of business infrastructure, as well as the concentration of science and technology parks, between the region of Belgrade and the region of Vojvodina on the one hand, and the region of Šumadija and Western Serbia and the region of Southern and Eastern Serbia on the other.

Bearing in mind that in the field of development of science and technology parks, the Republic of Serbia lags significantly behind the EU countries and many countries in the surrounding area, it is recommended that in the coming period, the existing science and technology parks significantly improve their capacities for using science in order to technological, as well as regional and economic development.

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Process Mining Maturity Assessment – Critical Success Factors

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Abstract: *In this paper, we present a literature survey of Process Mining and its identified implementation. The aim is the identification of the most prominent Critical Success Factors that should be achieved for successful process mining implementation. We concluded with ten proposed critical success factors that should be assessed in any process mining implementation. We also elaborate on the role of process mining in business process management and its contribution in resolving identified drawbacks.*

1. INTRODUCTION

Over the last decades, there is a rising interest from scholars and academics in Process Mining as it consists of a novel and multi-promising technological approach in multi-aspect process management. Process Mining, as an innovative tool, could provide an efficient and supportive framework for widely known industries connecting innovation with practical implementations. The management, through the implementation of Process Mining, from the daily information /input drift from multiple processes could lead to the production of new ideas/ concepts creating a smooth, diffuse and transparent entity (Reinkemeyer, 2020).

Process Mining refers to the discovery, monitoring and improvement of real processes by extracting knowledge from event logs (Van der Aalst et al., 2018, p. 8). Process mining implementations approach and investigate three different aspects related to the process/methods (how?), with the organization/ company (who?) and with the case /circumstances (what?) (Van der Aalst et al., 2007). The creation of specified and occurring maps of real processes in order to address different aims is one of the most exquisite potentials of Process Mining. Van der Aalst (2009) proposes the application of the analogy of Process Mining as a navigation system that could lead to organizational transformation.

Process Mining aims at the automatic extraction of process knowledge from event logs and makes possible the understanding of the functioning of even the most complex industrial processes. These industrial processes change over time, and through the process of mining, they can be analyzed dynamically (Corallo et al., 2020).

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2. BUSINESS PROCESS MANAGEMENT

Business processes are the key factor of organizations/corporations and form the ways that an organization manages and incorporates assets, daily facts/data and systems in order to improve their efficiency. The perceived quality of services by the customers and the efficiency of the provided services are both affected by the way processes are planned and implemented (Dumas et al., 2013). Nowadays there is a rapid change in organizations behavior and customers' expectations related mainly to new technological implementations and novel inventions (Brzychczy, 2017). As such, business processes need to be continuously monitored and relevant changes should be introduced.

Business Process Management (BPM) is the practice of evaluating, enhancing, and monitoring business processes for their continuous improvement (Houy et al., 2010). Specifically, BPM helps organizations inspect the variety of tasks that are performed and the way they are executed within the organization. Furthermore, BPM helps an organization to keep up with the market's latest evolutions and seek opportunities for process upgrades and expansion (Dumas et al., 2013; Rosemann & vom Brocke, 2010). Therefore, BPM can be broadly described as a provider of tools and techniques to efficiently manage business processes (Huang et al., 2011). BPM plays a key role in the advancement of an organization, which focuses especially on a business process view (Kohlbacher, 2009) because BPM can provide interaction, control, analysis, and optimization of processes (Smith, 2003).

BPM originated as the next big thing after the workflow wave (Anand et al., 2013). According to Weske et al. (2004), BPM systems were initially applied through different versions like workflow management (WFM), case handling (CH), enterprise application integration (EAI), enterprise resource planning (ERP), and customer relation management (CRM).

3. WEAKNESSES IN BUSINESS PROCESSES

A process weakness, as a part of a procedure with deteriorated performance, ineffectiveness or low levels of quality, is a similar concept of a weak point that was introduced by Coskun et al. (2008), which can be reformed into an elevated form. In order to improve the process, under the optimization probability of a weak point, specific remodeling factors need to be applied.

From a purely organizational perspective, a process is considered defective (weakness process) when for instance duties are not contacted in the optimum order or tasks are repeated twice. In contrast, new technological trends and applications could be beneficial in different organizational stages. A major part of process weaknesses activities is specified in data collection and information flows. This information flows primarily results from the division of business processes into individual parts (Berente et al., 2009). Consequently, there is no connection between weaknesses with a certain task/job during the process, but weaknesses are related to the planning and implementation of work and the processing of information widely (Algermissen et al., 2005).

Different processes are likely to appear with comparable elements of deficiency. Another approach, provided by Reijers and Liman Mansar (2005), suggests that the utilization of the most effective methods combined with personal experience and existing theoretical frameworks can lead to the reorganization and the implementation of innovation on business processes,

instead of just focusing on problematic spots. Despite their incomplete agreement with the classic weakness approach, Reijers and Liman Mansar (2005) highlight the fact that inefficient parts will enhance the possibilities of solving potential problems and creating new solutions. Some researchers have identified some typical weaknesses in the literature survey (Hammer & Champy, 1993; Davenport, 1993). As a result, we proceed in a classification of weaknesses into four distinct categories, as presented below. The level of information reformed (medium) through processing is taken under consideration, for instance, researchers evaluate the changes in manual entry of different types of paper, along with printing, scanning, or changes in manual data transmission between systems (Algermissen et al., 2005; Berente et al., 2009).

Reijers and Liman Mansar (2005) report indirect medium converts adopting a related approach during a “task elimination” process, as a more efficient method. Based on the above, the elimination of low customer-value tasks is proposed (e.g. Buzacott, 1996; Peppard & Rowland, 1995; van der Aalst & van Hee, 2004). Berente et al. (2009) argued that information deficits are situations where missing information prevents the further execution of the Process. Further investigations need to be taken into consideration to obtain the previous suggestion. The missing information can create serious disruption in the process by blocking supplies and causing serious delays in resources, demanding additional collaborative practices between other stages. Furthermore, Reijers and Liman Mansar (2005) proposed the application of “Information” as a best practice divided into subcategories: “control addition” and “buffering”. Control addition is related to the evaluation and improvement of the inflow and outflow information/data (Hammer & Champy, 1993; Poyssick & Hannaford, 1996; Buzacott, 1996). On the other hand, “buffering” is based on the update of the preserved incoming information through subscribing and not through demand. Additionally, organizational barriers were identified as a common source of problems (Davenport, 1993; Hammer & Champy, 1993). Organizational barriers occur when multiple organizational units are involved in a business process; these interactions can cause problems like waiting and idle Items (Berente et al., 2009) or create medium changes, the interaction between customers and vendors that could be an obstacle in a business process (Berente et al., 2009).

Moreover, incomplete cooperation among participants’ organizational units may lead to task duplication or excessive disciplinary actions. In the last decades, many authors identify a corresponding best practice “numerical involvement”, which proposes a reduction of staff and sections who are participating in a process (Reijers & Liman Mansar, 2005; Hammer & Champy, 1993; Rupp & Russell, 1994). Another important factor in the development of business processes is the implementation of information technology (Davenport, 1993; Margherita & Petti, 2010). Thus, if IT is utilized as an activated factor for automation or as a manual activities booster, the weakness type can beneficially affect the automation procedure. Better support can aim to avoid a large number of mistakes, for example, in calculations, and lead to more standardized processes. Information technology is considered an efficient means for the optimization of business processes (Reijers & Liman Mansar, 2005). Furthermore, a variety of best practices, that was suggested in the past remain timely, such as “Technology” category (distinguished into two best practices), “task automation” through the implementation of IT, or “Integration technology” using technological probes to surpass limitations in a process (Reijers & Liman Mansar, 2005; Hammer & Champy, 1993; Peppard & Rowland, 1995). An extra-close approach was also suggested by Klein (1995), Peppard and Rowland (1995), and van der Aalst and van Hee (2004).

4. CRITICAL SUCCESS FACTORS IN BPM IMPLEMENTATION

A variety of definitions attempted to address how BPM is considered a highly efficient and successful process, primarily focusing on two core factors, such as organizational elements and project/planning. According to [Trkman \(2010, p.126\)](#), “BPM is successful if it continuously meets pre-determined goals, both within a single project scope and over a longer period”. The level of success is mainly determined by the high proficiency of Critical Success Factors (CSF), which enhance and ensure business competitive performance in and across organizations ([Abdolvand et al., 2008](#)).

The need for a generic model of implementations in BPM by incorporating the most common and well-known reasons for success or failure, to provide organizations with a theoretical base to manage attitudes and increase their effectiveness, is pointed out by [Castro et al. \(2019\)](#), along with limited research activity.

Issues referred to top management support ([Goodyear, 2012](#); [Kassahun et al., 2011](#); [Kennedy et al., 2012](#)), project management and project management skills ([Jurisch, et al., 2012](#); [Weerakody et al., 2011](#)), communication and inter-departmental cooperation ([Alves et al., 2014](#); [Borras 2012](#); [Nfuka et al., 2011](#)) preparedness for organizational change ([Ahmad et al., 2007](#); [Meier et al., 2013](#)) are considered of high interest among academics and scholars in contrast to the reports in the CSFs related to BPM creativities, which are usually of general content. Specifically, top management support constitutes the most vital factor related BPM supportive efforts ([Ranganathan & Dhaliwal, 2001](#)). Moreover, leadership, investment IT infrastructure, and ICT awareness that are usually connected with traditional information systems are also used in BPM initiatives as widely known CSFs ([Lu et al., 2006](#)).

Despite the investment that organizations make in BPM initiatives, 60 to 80 percent of such initiatives have failed ([Trkman, 2010](#)). Such the risky nature of the BPM domain motivates further detailed evaluations of its critical success and failure factors ([Castro et al., 2019](#)).

A BPM success assessment framework suggested by [Malinova et al. \(2014\)](#), consists of ten interconnected factors. The proposed model was designed utilizing six main stages of the BPM implementation lifecycle ([Dumas et al., 2013](#)) and four central elements that influence BPM implementation ([Rosemann & vom Brocke, 2010](#)). However, the presented framework lacks the evaluation of technological inputs, which consists of the key factors of measurement in BPM efficiency and performs a critical role in contemporary organizational frameworks.

To design an analytical, and aligned with the market needs measuring framework for the evaluation and improvement of the BPM success and efficiency, research findings (such as case study results) and literature sources could be leveraged adding a new dynamic in the spread of BPM.

5. PROCESS MINING IN BUSINESS PROCESS MANAGEMENT

Nowadays, human resources in BPM or business optimization have close encounters with the emerged discipline of “process mining” ([van der. Aalst et al., 2011](#); [Dakic et al., 2019](#); [2020](#)). According to [Turner et al. \(2012\)](#), Process Mining systems accelerate the process event log visualization and analysis by applying algorithms and mathematical models and procedures.

For instance, collecting real data daily during a task completion allows for automatically modeling business processes to occur and detecting the potential bottlenecks and inefficiencies (Turner et al., 2012).

Van der Aalst (2011) suggests three distinguishing categories of PM: (a) process discovery, (b) conformance checking, and (c) model enhancement. Process discovery refers to forming a process model by defining a group of actions related to tracking event logs in certain business activities. Currently, algorithms originating from processes are developed and applied in a targeted manner in different fields such as e-learning, banking, insurance, and health care (Park & Kang 2016). Conformance is related to the diagnostic deviations of an event log and the corresponding process model to reinforce the process analysts to evaluate the factors that affect the quality of discovered process models and enhance elements such as auditing, Six Sigma, and compliance checking (van der Aalst, 2011). Finally, Model Enhancement describes the analysis of the process model for optimization potentials. For instance, an analysis of an event log containing information about resources would discover possible roles, work distribution mechanisms, and resource characteristics (van der Aalst, 2011).

The application of BPM systems such as BPMS, creates the perfect conditions for organizations to generate, analyze, perform, apply and plan the process models (Oruthotaarachchi & Wijayanayake, 2021). However, the aforementioned models have a low level of interaction with the actual operation of the process (Young, 2019). Process mining is offering an innovative approach to traditional BPM initiatives which is easily applicable and capable of enhancing and optimizing business processes (Dakic et al., 2018). Specifically, process mining techniques facilitate a dynamic system that reflects the changes in the process in real-time (Oruthotaarachchi & Wijayanayake, 2021).

The benefits from the conjunction of process mining techniques and traditional BPM are significant (Young, 2019). One of the most frequent and important deficiencies that BPM experts encounter is the efficient administration of the interaction between human resources during the conducted processes (Arias et al., 2018). Process mining can enable the efficient allocation of available human resources for the execution of process activities which will affect the process performance and cost limitations and will enhance the productivity of the resources (Arias et al., 2018). Process mining offers a major contribution to managing such problems within BPM disciplines by providing the appropriate mining tools for processes and relative activities evaluation (Cabanillas et al., 2015). The provision of a Google map-like facility to organizations' business processes is one of the most important applications of process mining in BPM (van der Aalst, 2011; Oruthotaarachchi & Wijayanayake, 2021). Oruthotaarachchi & Wijayanayake (2021) suggest the use of constant updates with real-time data through an up-to-date map for each process so that the information systems could predict potential "traffic jams" in processes and provide alternative solutions.

6. PROCESS MINING MATURITY FRAMEWORKS: THE NEED FOR HOLISTIC APPROACHES

The literature survey presented in this section is based on reviews of researchers that have taken into consideration hundreds of PM Human Resources frameworks and thousands of published journal papers in respected journals. This vast knowledge base proves that the topic has attracted the attention of thousands of researchers as well as the significance of the topic. However,

these reviews revealed the need for a holistic-integrated approach that incorporates the most prominent CSFs as well as the most prominent enablers (or resources). In our literature survey, we used the structured literature survey of Glykas Quality Compass (Bougoulia & Glykas, 2022; Glykas, 2015, 2019a, 2019b, 2022; Glykas, et. al., 2018; Glykas & Johnichen, 2017; Glykas, et. al., 2015; Kouroupaki, et. al., 2022; Vitzileou, et. al., 2022; Sachini, et. al., 2022). The data collection started with the search of the term process mining and human resources management and a sufficient number of articles were identified. Peer-reviewed, academic journals and English as the written language were used as criteria.

According to these criteria, a large number of articles that did not meet them were excluded. Then another key criterion was added the years of writing the articles. The period 2017 to 2021 was selected. The last criterion selected was the journals in which the articles are published. Process Mining is a concept that is constantly evolving, influenced by the advancement of technology and follows the operational needs of modern organizations and companies. This paper examined research papers published from 2017 to 2021 because it is a concept that has been integrated into the operation of companies on a global scale in recent years and therefore was an urgent need for its evaluation.

Over the past years, Process Mining (PM), as an emerging discipline specifically for business process management, has been applied in different sectors such as manufacturing supply-chain, government organizations, healthcare systems and software engineering (Dakic et al., 2019). Nowadays many researchers use Process Mining (PM) technique (Gupta, 2017; 2019; Arias et al, 2018; Batista et al., 2018; Dakic et al., 2018; 2020; Srivastava et al., 2019; Kouhestani & Bakht, 2020; Bicknell & Krebs 2020; Pereira et al., 2020; Wunnik et al., 2021; Nogueira et al., 2021) which is a unique approach to extract workflow models of actual real-world activities. Process Mining (PM) technics apply to determine, monitor and increase efficiency and effectiveness in different stages of processes and extract knowledge from event logs connected with real events (Dakic et al., 2018; 2020; van der Aalst et al., 2018; 2007). Due to its ability to improve business processes, track bottlenecks, and minimize costs and be applicable in a variety of industries/organizations, it is considered a rapidly evolving research field (Dakic et al., 2020; 2018; Djedovic et al. 2017).

Several literature reviews highlight the application of PM tools in healthcare from different point of view, specifically in clinical guidelines and pathways, the oncology field and health care units' management. Especially in high demanding and conforming environments like hospitals with complex procedures and unstable variables, the use of these mining techniques can be proved quite challenging (Martin et al., 2020). Erdogan & Tarhan (2018) presented the results of a Systematic Mapping (SM) which is conducted to structure the information available in the primary studies. Evolutions in data Process Mining algorithms combined with the accessibility of complicated software have formed fertile conditions for innovations and technological applications in simulation modeling (Kouhestani, 2019; Ribeiro et al., 2020). More specifically, Mesabbah et al. (2019) presented a hybrid Process Mining framework for automated simulation modeling for healthcare aiming to improve ER process, arising from the necessity of a highly coordinated team of medical professionals during emergency incidents. In addition, Alvarez et al. (2018) attempt to approach the importance of interaction models in Emergency Rooms (ER) processes utilizing process mining techniques, imprinting the dynamic perspective of healthcare professionals' collaboration; In that way is allowed the discovery of role interaction models through the use of real-life clinical data and process mining techniques. According to Pereira et al. (2020), Process mapping in the healthcare environment provides several managerial benefits,

which are reflected in the quality of patient care; specifically, mapping the processes through a method called “Process Mining” could lead to significant results, such as improving the quality of health services. Furthermore, [Pereira et al. \(2020\)](#) developed a Process Mining project methodology in healthcare, which was a case study in a tertiary hospital. The suggested methodology was developed progressively through an overview of the methodological approaches applied to Process Mining in the generic applications of Process Mining in health case studies ([Pereira, et al. 2020](#); [Martin, et al., 2020](#); [Dunkl, et al., 2011](#)).

According to [Martin et al. \(2020\)](#), healthcare systems are facing constantly demanding factors such as low budgets and rising care needs. To confront these challenges, practitioners raise awareness related to the medical need and the assurance of care-services quality ([Martin et al., 2020](#)). As a result, [Martin et al. \(2020\)](#) designed proposals for enhancing the utilization and perception of Process Mining in healthcare, aiming towards the development of a new research agenda target in Process Mining applications in healthcare.

Process Mining (PM) initiatives have also an impact on Business Process Management. Nowadays, there is a growing tendency in global industries in evidence-based management. According to [Cho et al. \(2017\)](#), business process evaluation indicators tend to focus on process performance underestimating factors related to the evaluation of different perspectives of the business process lifecycle. As a result, [Cho et al. \(2017\)](#) propose a new framework of business process assessment, aiming mainly at the reformation process of the lifecycle phase and combining it with process mining as an operational framework to calculate indicators.

Organizations use Business Process Management to identify opportunities to reduce costs, increase service or product quality, etc. [Djedović et al. \(2017\)](#) presented a new method of enhancing Business Processes using Process Mining tools and standard methods of business process utilization. These days, organizations use Business Process Management (BPM) around the world to maintain a competitive advantage related to their Business Processes (BP). [Lamghari et al. \(2019a; 2019b\)](#) approached business process improvement metrics based on the BPM life cycle and Process Mining techniques. Recognizing specific improvement metrics according to the BP types is always a challenge for Business Process efficiency ([Lamghari et al., 2019a; 2019b](#)).

[Kouhestani \(2019\)](#) argues that Building Information Modelling (BIM) can address the demands of the generation and management of the digital representation for building products by combining building elements and their information in a unique project ([Kouhestani, 2019](#)). [Kouhestani \(2019\)](#), assists BIM and project managers by enabling BIM as a management tool for design processes via some algorithms. In this way, all businesses have continuous improvement. [Ribeiro et al. \(2020\)](#) are focusing on using BIM to capture the digital footprints of project actors and create event logs for the design authoring phase of building projects by using files in IFC (Industry Foundation Classes) format, collected during the design process ([Kouhestani, 2019](#)). A BIM manager can implement such measures in monitoring, controlling and re-engineering work processes related to design authoring.

Process Mining is a new kind of Business Analytics and has emerged as a powerful tool. [Zerbino et al. \(2021\)](#) conducted a management-oriented literature survey on Process Mining and Business Management to assess the state of the art and to open the way for further study. In that way, stimulates the application of Process Mining in promising business contexts and mostly unaddressed managerial areas.

Process Mining (PM) plays a major role in a strategy. [Juhanak et al. \(2019\)](#) applied a process-oriented approach investigating perspectives on using Process Mining methods in the context of online learning and assessment. The results of the study highlight that Process Mining methods can be used to detect the standard quiz-taking behavior pattern and differentiate it from non-standard or aberrant behaviors. These methods simultaneously allow for identifying and differentiating between various types of non-standard student behaviors during involvement with quiz-taking learning activities in LMS ([Juhanak et al., 2019, p. 9](#)). Process Mining provides insight and a deep understanding of customer preferences and behaviors. [Dogan et al. \(2019\)](#) analyzed Gender Behaviors via Process Mining in a case study of a shopping mall application. Moreover, [Michael et al. \(2019\)](#) developed a privacy-preserving method planned for Process Mining in which information systems provide event data aiming to point out the real implementation of business processes in organizations. The System Design allows tracking who does what, when, why, where and how using personal data as the central view is targeted at the user. As a result, an ABAC-based authorization model to support the eight privacy design strategies for event logs was adopted ([Michael et al., 2019](#)).

[Mannhardt's \(2018\)](#) study was focused on problematic situations where a multi-perspective approach to processes was necessary to predict potential control-flow deficit, capable of determining the repetition of activities of a process. For instance, topics like flow data, resource allocation, duration, and functions that demand specific control and are interconnected should be considered together. Mining techniques attempt to extract non-trivial knowledge and insights from activity logs and use them for further analyses. [Yang \(2019\)](#) explored how Process Mining can be used in real-world process analysis to reveal process insights and help human decision-making by using activity logs and further analyses.

Process mining provides valuable insights into business processes using event logs, whereas goal modeling focuses on the representation and analysis of competing goals of stakeholders. [Ghasemi & Amyot \(2020\)](#) provided a systematic literature review that assessed the state of goal-oriented Process Mining. The literature survey emphasizes the fact that the application of process mining in correlation with goal setting lacks research coherence whereas intention mining reveals a potential topic for further research ([Ghasemi & Amyot, 2020](#)). The previous scientific field is developed by taking into account the notions of intention and strategies of the process enactment.

Process Mining is an emerging issue that exposes various challenging topics, with the most significant being presented in the Process Mining Manifesto. [Lamghari et al. \(2019a, 2019b\)](#) provided researchers with the recent challenges that emerged during the passage from a data-intensive system to a knowledge-intensive system. Implementing methods to extract knowledge from databases can guide the decision-making process. [Ribeiro et al. \(2020\)](#) described the challenges and the opportunities that Data Mining methods offer to Human Resources Management and conducted it through an application of an algorithm step, the Gower's Distance coefficient.

Process Mining enables organizations to streamline and automate their business processes. [Zerbato et al. \(2021\)](#) reported the results of an empirical study investigating exploration practices in process mining. The primary stages of Process Mining projects usually contain elaboration actions, focusing on data best perception and process assimilation. [Bicknell & Krebs \(2021\)](#) provide an attempt to unify the optimum reproductive methods into a complicated grouping algorithm to progressively optimize the research of suspicious software, cross-platform weaponization, and plan data related to warfare campaigns from the past.

Table 1. Literature Survey Finding Table: PM Perspectives and Critical Success Factors

Reference	CSF FOCUS										ENABLERS	
	STRATEGIC	CUSTOMER	HUMAN RESOURCES	PROCESS	LEADERSHIP	CHANGE MANAGEMENT	PERFORMANCE MEASUREMENT	CONTINUOUS IMPROVEMENT	INFORMATION AND KNOWLEDGE MANAGEMENT	CORPORATE SOCIAL RESPONSIBILITY	SUPPLIER RELATIONSHIP	ORGANIZATIONAL ELEMENT ENABLERS
Cho et al., 2017			✓	✓	✓	✓	✓	✓	✓			✓
Djedović et al., 2017		✓	✓	✓	✓	✓	✓	✓	✓		✓	✓
Gupta, 2017		✓	✓	✓		✓	✓	✓	✓			✓
Arias et al., 2018	✓	✓	✓	✓	✓	✓	✓	✓	✓			✓
Mannhardt, 2018	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Sikal et al., 2018		✓	✓	✓	✓	✓	✓	✓	✓			✓
Erdogan & Tarhan, 2018		✓	✓	✓	✓	✓	✓	✓	✓	✓		✓
Batista & Solanas, 2018		✓	✓	✓	✓	✓	✓	✓	✓	✓		✓
Van der Aalst, 2018		✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Alvarez et al., 2018	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓		✓
Jokonowo et al. , 2018		✓	✓	✓	✓	✓	✓	✓	✓	✓		✓
Mahendrawathi et al., 2019	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓		✓
Lim et al., 2018	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓		✓
Lamghari et al., 2019(1)		✓	✓	✓	✓	✓	✓	✓	✓		✓	✓
Yang ,2019			✓	✓	✓	✓	✓		✓		✓	✓
Kouhestani & Sobhan, 2019			✓	✓	✓	✓	✓	✓	✓	✓		✓
Lamghari et al., 2019(2)		✓	✓	✓	✓	✓	✓	✓	✓		✓	✓
Juhaňák et al., 2019		✓	✓	✓	✓		✓		✓			
Dogan et al., 2019		✓	✓	✓		✓	✓	✓	✓			✓
Mesabbah & Abo-Hamad, 2019		✓	✓	✓	✓	✓	✓	✓	✓		✓	
Dakic et al., 2020		✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Srivastava et al., 2019	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓		✓
Koschmider & Mannhardt, 2019	✓	✓	✓	✓	✓	✓	✓	✓	✓		✓	✓
Dakic et al., 2018		✓	✓	✓	✓	✓	✓	✓	✓		✓	✓
Martin et al., 2020		✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Ghasemi & Amyot, 2020			✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Kouhestani & Nik-Bakht, 2020		✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Bicknell & Krebs, 2020	✓	✓	✓	✓	✓		✓	✓	✓		✓	

Pereira et al., 2020			✓	✓		✓	✓	✓	✓	✓	✓	✓	✓
Andrews et al., 2020	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓		✓	✓
Kedem-Yemini, 2020	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓		✓	✓
Ruschel et al., 2020	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Aloini et al., 2020		✓	✓	✓	✓	✓	✓	✓	✓	✓		✓	✓
Harl et al., 2020		✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Bicknell & Krebs, 2021		✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Martino & Cante, 2021			✓	✓	✓	✓	✓	✓			✓	✓	✓
Zerbato et al., 2021	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓		✓	✓
Maddah & Roghanian, 2021	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Nogueira & Zenha-Rela, 2021			✓			✓	✓	✓	✓		✓	✓	✓
Van Wunnik et al., 2021		✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Zerbino et al., 2021		✓	✓	✓	✓	✓	✓	✓	✓		✓	✓	✓
Lorenz et al., 2021	✓	✓	✓	✓	✓	✓	✓	✓	✓		✓	✓	✓
Grajewski et al., 2021	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Hicham & Anis, 2020		✓	✓	✓	✓	✓	✓	✓	✓		✓	✓	✓
Aloini et al., 2021	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Lameijer et al., 2021	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓

Source: Own research

In recent decades, the business process is considered a fertile and emerging research field due to rising academic interest in Process Mining systems and the use of event logs for the invention of new applications. [Sikal et al. \(2018\)](#) propose a novel pattern for variability discovery in configurable processes. Specifically, the application of mining tools in different stages of business processes will significantly automate process systems and aspects related to creativity, discipline, and development ([Sikal et al., 2018](#)). [Martino et al. \(2021\)](#) identify and analyzes the 'outlier' processes that have been developed and detect characteristics that could justify delays in the processes' completion.

Process Mining is a useful tool for businesses to improve their performance measurements. [Djedovic et al. \(2017\)](#) improve business processes using Process Mining techniques and a standard method of business process improvement is presented. The implementation of basic performance indicators, for the evaluation of process performances and a process model, are also provided along with an improved version of a resource allocation, regarding preconcerted main performance suggestions ([Djedovic et al., 2017](#)).

Furthermore, [Maddah et al. \(2021\)](#) suggest an analytic framework for the evaluation of the performance of business departments of an organization, aiming at the identification of performance indicators with significant influence, and giving space to managers for documented decisions related to data extracted from the operational information systems. In that way, it improves the business department's performance of an organization with a process perspective and enables managers to make more informed decisions.

According to Dakic et al. (2018, 2019, 2020), process mining utilizes real event data, presented like event logs, which are retrieved mainly from Process-Aware Information Systems (PAIS), to configure automated business process models and upgrade the existing ones by comparing event log of the same process, aiming mainly to converge process model analysis and data-oriented analysis. In addition, Dakic et al. (2018, 2020) proposed a useful implementation of Process Mining on manufacturing data retrieved from ERP systems. The limited volume of reference points and mining techniques were approached by the researcher through the comparison of two well-known process mining systems and result evaluation, aimed at the creation of a new methodological approach for this specific situation (Dakic et al., 2018, 2019, 2020).

In Table 1, we present CSF occurrence per reference, as well as the references whose authors propose CSF classification in categories.

7. DISCUSSION AND CONCLUSIONS

In the previous section, we presented a literature survey to identify the most prominent CSFs that can be used in assessing process mining implementation maturity assessment.

We have identified the ten most prominent CSFs. There are five **core CSFs**, namely the ones assessing the contribution of process mining implementations in achieving: *Strategic Customer, People, Leadership and Process* related objectives or measures. Three intra-core CSFs assess the implementation achievements of the previous five critical CSFs in relation to: *Performance Measurement, Change Management and Continuous Improvement*. We have also identified two **auxiliary CSFs** that are used recently in many process mining implementation initiatives: *Knowledge-Information Management and Stakeholder Management-Corporate Social Responsibility*.

In our future research, the proposed CSFs will be included in a maturity framework that will encompass maturity stages and the acceptable result ranges of each of the ten CSFs in each stage.

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EFQM Excellence Model – A Systematic Literature Review. A Proposal FOR a Maturity Assessment Framework

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Abstract: Performance Improvement is high on the agenda of most organizations worldwide. A growing number of improvement models are now available, and it is necessary to adopt an approach to earn the most attractive organizational excellence performance. One such practice is implementing the EFQM Excellence model, which is a self-assessment framework for determining the strong and weak points and measuring areas of improvement of an organization across continuous quality improvement. EFQM Excellence Model is used by any kind of organization regardless of size, sector, maturity and structure. Following the identification of the most known CSFs, we present the Glykas Quality Compass (GQC), a novel methodology for assessing the Quality Management Maturity that assesses implementation projects holistically and thoroughly using a matrix of critical success factors (CSFs) and enablers. The proposed methodology for maturity assessment might be specifically applied to the four quality management categories: Total Quality Management, Quality Standards, Quality Methodologies and Excellence Awards.

1. INTRODUCTION

Changing market conditions and continuously increasing intense competition day by day affect most organizations throughout the world to being more and more competitive. European Foundation for Quality Management has developed “EFQM Business Excellence Model” to lead these companies that are in search of business excellence. European Foundation for Quality Management (EFQM) was established in 1988 by 14 leading European companies with the mission of “Being Stimulus of Sustainable Excellence” and the vision to create “A World That European Organizations Strive Excellence” (Nabitz et al., 2000). European Foundation for Quality Management (EFQM) now serves over 800 organizations (members) in different countries worldwide. The organizations, which are represented by the EFQM, are companies that are composed of the most known and successful brands all over the world.

The EFQM Business Excellence Model is a useful tool that presents companies’ current position toward excellence and assists them in identifying opportunities and defects. EFQM Business Excellence model is a widely used organizational framework in Europe, which main components are customer and employee satisfaction, and excellent business results in society. The EFQM Excellence Model was based on the principles of Total Quality Management (TQM). In this respect, the model is the most known and applied in Europe for TQM. EFQM inspires organizational awareness. Therefore, the EFQM Excellence Model and TQM complement each other and assist organizations and businesses to survive in the current competitive market situation (Inan et al., 2010).

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Furthermore, EFQM and Total Quality Management complement each other to inspire organizations' awareness and to achieve their existence in the current competitive market.

The original version of the European Model for Total Quality Management was updated by gathering inputs from years of application in changing market conditions that are made inside and outside Europe. The new EFQM version was launched in November 2019 to replace the previous version of 2012 (EFQM, 2022).

The recently published EFQM 2020 Model is aligned with European business ethics values and United Nations Sustainable Development Goals (SDGs) (Fonseca, 2022). In comparison to its previous version, EFQM 2013, the term "excellence" is no longer explicitly present and in most cases has been replaced by the term "outstanding" (Nenadál, 2020). The EFQM 2020 model is less prescriptive compared to EFQM 2013 and it is composed of seven criteria grouped in three dimensions, namely: Direction (why), Execution (how), and Results (what) (EFQM, 2022). The seven criteria are further subdivided into 23 criteria parts and 2 results criteria, and 112 guidance points. The methodology tool that EFQM has developed is called RADAR (Result, Approach, Deploy, Assess, and Refine).

2. LITERATURE REVIEW: MATURITY ASSESSMENT IN QUALITY MANAGEMENT

2.1. Quality Management (QM)

Much has been written about Quality Management (QM) practices and how they have now been embedded into the organization's operations. Quality Management (QM) was developed almost two decades ago with the core ideas of "quality gurus", W. Edwards Deming, Joseph Juran, Philip Crosby and Kaoru Ishikawa. Quality Management provides an all-pervasive management approach to competitiveness and a means for achieving business excellence in organizations. Finding its way into most sectors of today's business environment, Quality Management (QM) has developed to serve all the business sectors and increasingly constitutes a very important research area for further research.

According to Dale et al. (1994), Quality Management (QM) has "four stages". The first stage is described as the Inspection Stage. The inspection process is the first stage, which includes all information gathered for products and service improvement and the insurance that all finished organization's products have been examined, to guarantee quality (Evans & Lindsay, 2005). The second stage of Quality Management is Quality Control (QC). The Quality Control process ensures that the quality goals are met during the organization's operations (Evans & Lindsay, 2005). Quality Assurance (QA) is the third stage, which includes all the necessary actions regarding the customer's needs, providing them with services or products, which fulfill the required standard (Boharan & Ziarati, 2002). Total Quality Management (TQM) is the fourth stage of Quality management. The TQM process is associated with long-term success through customer satisfaction, applying all the quality management concepts and principles to every operation of the organization.

2.2. Maturity Assessment (MA)

The concept of 'maturity' is clearly defined by Soanes and Stevenson (2006), as: "The state of being complete, perfect or ready." Quality Maturity Assessment is a way of examining a range

of an organization's capabilities that are required to support innovation (Paulk, 2018). Maturity assessment was described by Wilson (2015) as a way of establishing outputs, inputs, customer and staff satisfaction and performance measurement counted with other parameters (Wilson, 2015). One way of assessing maturity assessment in this sense is by using Quality Maturity Models (QMM). Quality maturity models help to identify organizational strengths and weaknesses, according to Khoshgoftar and Osman (2009). Furthermore, maturity models are crucial tools for the assessment of specific organizational capabilities against a benchmark standard (Brown, 2013).

Organizations continuously attempt to improve their Quality Management System (QMS) maturity level to achieve their mission, goals and objectives. Quality Management (QM) implementation maturity assessment provides useful means to examine the possible capabilities of supporting innovation (Paulk, 2018). This kind of assessment reviews organizational activities to identify possible weaknesses and then seeks recommendations for their improvement. Assessment is generally achieved via audits, both internal and external. However, audits alone are not sufficient. Valadao et al. (2013) highlight the importance of organizational self-assessment. The aim of this assessment is the achievement of the continuous improvement of the maturity level of the Quality Management System.

2.3. Continuous Improvement (CI)

Continuous Improvement is an extremely important phenomenon that has been considered a vital element in achieving an organization's excellence. This may result from the continuous changes in the business environment and the emergence of the adoption of quality management systems. The development of the Continuous Improvement concept follows the quality evolution. The concept of Continuous Improvement came from the Japanese term Kaizen which was first spread by the father of continuous improvement, Masaaki Imai. Kaizen is a combination of two Japanese words that includes two main concepts: Kai (do, change) and Zen (well, to improve). Bessant et al. (2001) described "continuous improvement" as a continuous, incremental innovation process, targeted and involves every aspect of the organization. Mello et al. (2009) pointed out that continuous improvement is a formal requirement, and it is up to organizations to continuously seek efficacy and efficiency improvements to their operations. Continuous Improvement (C.I.) focuses on increasing organizational efficiency and effectiveness, which leads to costs and time reduction (Rio-Rama et.al., 2016).

2.4. Quality Maturity Models

The methods of assessing the level of a quality management system (QMS) resulted from the organizational maturity models. Quality maturity models have developed from the TQM concept. Hence, these models entail a detailed understanding of the current and future position of the entire company. Furthermore, the Quality Maturity Assessment process assists in identifying an organization's strengths and weaknesses (Khoshgoftar & Osman, 2009), as Quality Maturity Models provide the appropriate frameworks for the way toward the organization's better performance.

A thorough analysis of the literature has been done on the various models that can be used to determine the organization's level of quality maturity (De Bruin et al., 2005). De Bruin et al. (2005) identified three key characteristics of maturity models, including a descriptive maturity model, a

prescriptive maturity model and a comparative maturity model. Regarding the descriptive maturity model, it is appropriate for assessing the existing and the current situation of the organization, offering a deeper understanding of a prevailing situation. A prescriptive model specifies how to identify the desirable future maturity level, providing measures for improvement. The comparative model benchmarked similar practices across organizations against disparate industries.

Several models have been developed for assessing the maturity of an organization. The concept of maturity was first proposed by Philip Crosby. One of the earliest maturity models for determining the level of quality maturity was created in 1979 and is known as Crosby's Quality Management Maturity Grid (QMMG). Crosby's model identifies the current situation concerning maturity (Crosby, 1979). Bessant's Continuous Improvement Capability model was created by John Bessant in 1997 and it is a helpful model for organizations to understand where they stand concerning other organizations and to improve their Continuous Improvement capability (Bessant et al., 2001). Capability Maturity Model (CMM) was developed in 1987 by the Software Engineering Institute (SEI) at Carnegie Mellon University and it offers a guide for organization to manage its process to C.I. (Paulk, 2018). Capability Maturity Model Integration (CMMI) was created in 2000 and it is a model which has common features with CMM and ISO 9000 (Albliwi et al. 2014).

Two, also, notable maturity models used for performance measurement and change are the Balanced Scorecard (BSC), using a more customer-oriented strategy towards the change and the European Foundation for Quality Management (EFQM) Excellence Model, paying more attention to factors that contribute to the organization's success. Certainly, in the future, it is worth examining the quality maturity models as they offer a critical measurement tool for assessing the quality management system maturity of the organizations.

3. LITERATURE REVIEW: CRITICAL SUCCESS FACTORS IN EFQM IMPLEMENTATION

Table 1 presents the Critical Success Factors proposed by all literature surveys of EFQM. The literature review aims to identify the most prominent CSFs proposed in the literature mainly during the last decade.

From the Table 1 it is evident that in the literature there are nine critical success factors in EFQM. One of the contributions of the research presented in this paper is related to the categorization of CSFs that should be included in future Maturity Assessment Frameworks. The most noticeable CSFs determined in the literature survey as presented in the table above are Leadership, Strategy, People, Partnerships & Resources, Processes, Products and Services, Customer Results, People Results, Society Results and Business Results. The context and structure of the EFQM Excellence Model consist of nine criteria. Five criteria out of nine generate "input" criteria while four criteria out of nine generate "result" criteria.

3.1. Leadership

Leaders develop the mission, vision, and values of an organization. Excellent organizations have leaders who shape the future and lay the foundation for it. Leaders of excellent organizations have flexible personality and guarantee that the organization will be led to success by estimating and carrying out crucial factors. Leaders must become involved with customers, partners, and representatives of society.

Table 1. Literature Survey of EFQM

Critical Success Factors-CSFs									
Reference	Leadership	People	Strategy	Partnerships & Resources	Processes, Products & Services	People Results	Customer Results	Society Results	Business Results
Amin Ahmadi Digehsara, Hassan Rezazadeh & Mohamad Soleimanic. (2018).		✓		✓	✓				
Yung-Lun Liu & Pen-Fa. (2017)							✓		
Calvo-Mora, A., Blanco-Oliver, A., Roldán, J.L. & Periañez-Cristóbal, R. (2020)	✓	✓	✓	✓	✓				✓
Fernando Criado-Garcia, Arturo Calvo-Mora & Silvia Martelo Landroguéz. (2020)				✓					✓
David Hemsworth (2016).	✓	✓	✓	✓	✓				✓
Juan Antonio Giménez Espín, Micaela Martínez Costa & Daniel Jiménez Jiménez (2022)	✓	✓							
Đorđević A.; Klochkov, Y.; Arsovski, S.; Stefanovic, N.; Shamina, L. & Pavlovic, A. (2021)	✓			✓					
Madi Bin Abdullah, M., Uli, J. & Jose Tari, J. (2008)	✓	✓			✓		✓		
Kafetzopoulos, D. & Gotzamani, K. (2019)	✓	✓	✓	✓	✓				
Katarzyna Szczepańska & Małgorzata Wiśniewska (2013).	✓								
Murthy, N., Sangwan, K.S. & Narahari, N.S. (2022)	✓	✓	✓	✓					
Arturo Calvo-Mora, Araceli Picón-Berjoyo, Carolina Ruiz-Moreno & Lourdes Cauzo-Bottala. (2014)								✓	✓
Mohammed H. & Alanazi (2020)	✓	✓					✓		
Arturo Calvo-Mora, Carolina Ruiz-Moreno, Araceli Picón-Berjoyo & Lourdes Cauzo-Bottala (2014)	✓	✓		✓	✓				
Calvo de Mora Schmidt, A., Cauzo Bottala, L., Picón Berjoyo, A. & Ruiz Moreno, C. (2012).	✓	✓	✓	✓	✓				
L. Para-Gonzalez, D. Jiménez Jiménez & A. R. Martínez-Lorente (2018)	✓	✓							
Iadimirin, O. T., Chukwurah, P. O., & Makanjuola, A. S. (2019).	✓	✓			✓				
Sfakianaki, E., Kakouris, A. & Siontorou, C. (2021)	✓	✓			✓				
Elen Paraskevi Paraschi, Antonios Georgopoulos & Panagiotis Kaldis (2019)	✓		✓			✓			
Ashraf, H.A., Ishaq, M.I. & Muhammad Khan, M. (2021).		✓							
Georgiev, S. & Ohtaki, S. (2020).	✓	✓							
Zhang, J., Li, H., Li, V., Xia, B. & Skitmore, M. (2021).	✓	✓	✓	✓	✓				
Santos, G., Afonseca, J., Lopes, N., Filix, M. J. & Murmura, F. (2018).	✓		✓						
V. Jagannathan & A. Mohammed Faisal (2019)	✓	✓					✓		
Kannusamy Panneer Selvam, P. & Thangavelu, R. (2019).	✓		✓						
Gomez-Lopez, R., Serrano-Bedia, A.M. & Lopez-Fernandez, M.C. (2019).						✓	✓	✓	✓
Asadi SA, Hosseini Bargzan S, & Sokhanvar M. (2018)	✓	✓				✓	✓		
Portela Maquieira, S., Tari, J.J. & Molina-Azorin, J.F. (2020).	✓	✓			✓				
Kaplani G., & Zfiropoulos K. (2021).		✓	✓	✓					
Osman, M. I. [et al.]. 2021	✓								

3.2. Strategy

The structure of strategy is a significant step for quality. By following the opportunities and threats of the market, and sharing all processes with employees, organizations can create a policy

and strategy which is based on the present and future expectations and needs of its stakeholders. Excellent organizations create their mission and vision by creating a shareholder-based strategy.

3.3. People

Human resource is the only and necessary factor so that organizations can compete and survive in the market's competitive circumstances. Employees should have the opportunity to take part in the decision process and reveal their skills to an excellent organization. Excellent organizations value their employees and create a vision and mission from which they and their shareholders benefit one another.

3.4. Partnerships & Resources

Excellent organizations plan and manage their cooperation with external partnerships. Once the organization examines its cooperation and resources, the cooperation with external partnerships will be easily managed.

3.5. Processes, Products and Services

The most important one among input criteria is the systematic design and management of the processes. An excellent organization should design and develop its products and services based on customer needs and expectations. Excellent organizations design processes, products and services and manage and enhance them to improve quality and to enhance customer relationships.

3.6. Customer Results

Result criterion related to customers indicates that excellent organizations achieve and sustain outstanding results that meet the expectations and needs of their customers. When observing how the reputation and image, the product and service value, the customer loyalty and engagement have an influence on customers in detail, it is aimed that product or service quality will reach the highest level. How serious the organization considers the product and service delivery, the customer service and support or the complaints handling is a key point in customer results criterion. Another crucial element is how effectively the overall support processes are carried out before and after the sales in order to foster client loyalty.

3.7. People Results

The result criterion related to employee efficiency is crucial as it also measures the employees' satisfaction. When examining to which extent the target of the organization has been reached, the employees' performance is assessed impartially. Absence rate, duty ratio, satisfaction and participation in the organization's processes are an overview of the employee's performance.

3.8. Society Results

The organization is not composed of only employees and customers; society is also important as customers. Therefore, it is impossible to ignore the damages and benefits in society. The contribution to the local and national economy is also used to examine whether the organization is appropriate and regarded as an excellent organization.

3.9. Business Results

Achieving and sustaining outstanding results that meet or exceed the needs and expectations of the organization's stakeholders can result in an excellent organization. The results of Key Performance are divided into two separate sections, financial and non-financial results. Sales, profit, budget and cash flow are included in the financial results. In nonfinancial results, the management of cycle processes and productivity are examined.

In conclusion, the input requirements relate to how the organization operates to achieve business outcomes and how it achieves these results. Results criteria are related to the accomplishments and goals of the company (in terms of business results). Excellent organizations are regarded the organizations that have reached a high level of performance for all, both input and output criteria.

4. A PROPOSED MATURITY ASSESSMENT FRAMEWORK

Maturity Assessment Framework – Glykas Quality Compass (GQC) Maturity Assessment Framework

In the previous section, we presented the nine main dimensions of EFQM Excellence Model. The most prominent CSFs identified are: Leadership, Strategy, People, Partnerships & Resources, Processes, Products and Services, Customer Results, People Results, Society Results and Business Results. The novel holistic Quality Management Maturity Assessment Framework, called Glykas Quality Compass (GQC) is proposed in this section and has been applied to a variety of industrial sectors. The proposed GQC maturity assessment framework is categorized into four quality management perspectives (philosophies, frameworks, standards, and excellence awards) and analyzes the successful implementation of Quality Management through the analysis of ten key quality concepts. In GQC, management principles are viewed as necessary conditions or factors to achieve the ten quality concepts. The ten quality concepts are further categorized into three categories, which are: five core concepts (customer focus, human resource management, leadership, process, strategy), three intra-core concepts (performance measurement, change measurement, continuous improvement) and two auxiliary concepts (collaborations and corporate social responsibility and information/knowledge management) (Glykas, 2019).

4.1. Five core concepts:

Strategy: The organization's vision and quality management system are both closely related to the strategy. An organization with a well-defined strategic direction will reach higher levels of internal and external customer satisfaction, greater employee involvement, commitment and contribution, and improve human efficiency and performance. The strategy is directly related to driving and achieving the organization's vision.

Customer: Focuses on actions intimately related to meeting the customer's needs and expectations.

Process: It concerns processes and mutually reliant activities that turn inputs into outputs and generate value while increasing quality and productivity levels.

People: To fulfill the organization's goals, people at every level of an organization must take an active role and participate. Through active engagement, employees gain new knowledge and experiences, realize the value of quality, and go up their commitment to the organization.

Leadership: One of the most crucial factors in the continuous improvement (C.I.) process of the quality organization is the appropriate high-level executive management. The decision-making process and quality policy definition must be following the leader's overall instructions. The organization's leadership should develop and communicate the vision and strategy, as well as ensure that all the employees are actively participating in achieving the organization's objectives.

4.2. Three intra-core concepts:

Performance Measurement: Evaluation, measurement and determination of an employee's performance are all considered in the performance measurement. According to the description of the position, it is determined whether the position holder fulfills the requirements of the job description. Through the performance measurement process, the employee is informed and motivated to work at the highest possible level of performance by receiving the necessary and ongoing assistance. Each employee's personal growth is ensured through this procedure, which also encourages job satisfaction, motivation and dedication to the company's goals.

Change Measurement: Change Management is measured through evaluation techniques and corrective actions throughout the entire organization. Measurements are taken, data is gathered, examined and used to produce corrective measures that may result in the adoption and support of change. To give the company the data it needs to make informed decisions about how to modify its strategies and take the appropriate corrective action to reach its objective; change management metrics should be seen holistically.

Continuous Improvement: Continuous improvement, focusing on enhancing value-added activities throughout all organizational processes is included in this process. The employment of strategies that will teach them about process improvement and workflow management will be beneficial for organizations with a culture of continuous improvement.

4.3. Two auxiliary concepts:

Corporate responsibility: The impact an organization has on society, the environment, the economy and all stakeholders are the subject of corporate responsibility. Effective corporate responsibility programs enable businesses to operate in ways that benefit society and the environment while also adding value to the business itself. CSR initiatives can also assist strengthen the relationship between staff members and the company, raise spirits, and promote dedication.

Information-Knowledge management: Knowledge management is the process of defining, maintaining and exchanging employee knowledge and experience within a company. By eliminating prior ineffective methodologies and strategies, knowledge management involves a cycle of knowledge generation and exchange that maximizes collaborative know-how and improves performance. Employees are urged to share knowledge in businesses where learning and development are valued to enhance the workforce and realize knowledge management objectives.

The aforementioned ideas are used in all four quality perspectives (Total Quality Management, standards, methodologies and quality excellence awards) and are in accordance with the PDCA (Plan-Do-Check-Act) cycle for continuous improvement. The Deming cycle, often known as the PDCA Cycle, is a process with four steps: Plan, Do, Check and Act. The most important stages in the execution of quality management are planning and pursuance (Do), which look at how all organizational aspects are planned to support and regulate the implementation following the organizational resources available. The quality management principles, the organizational structure, the processes, the job descriptions and the management systems are all considered organizational factors in GQC during the planning stage. Land, buildings, equipment, human resources, capital and information systems are all considered organizational resources and all are included in the Execution stage (Glykas, 2019).

The Glykas Quality Compass (GQC) framework offers a matrix/a ten-to-ten table (Figure 1), that lists the ten most important, critical-success factors, which are identified in recent maturity-assessment frameworks and the ten, best-known factors, which are identified in the existing literature.

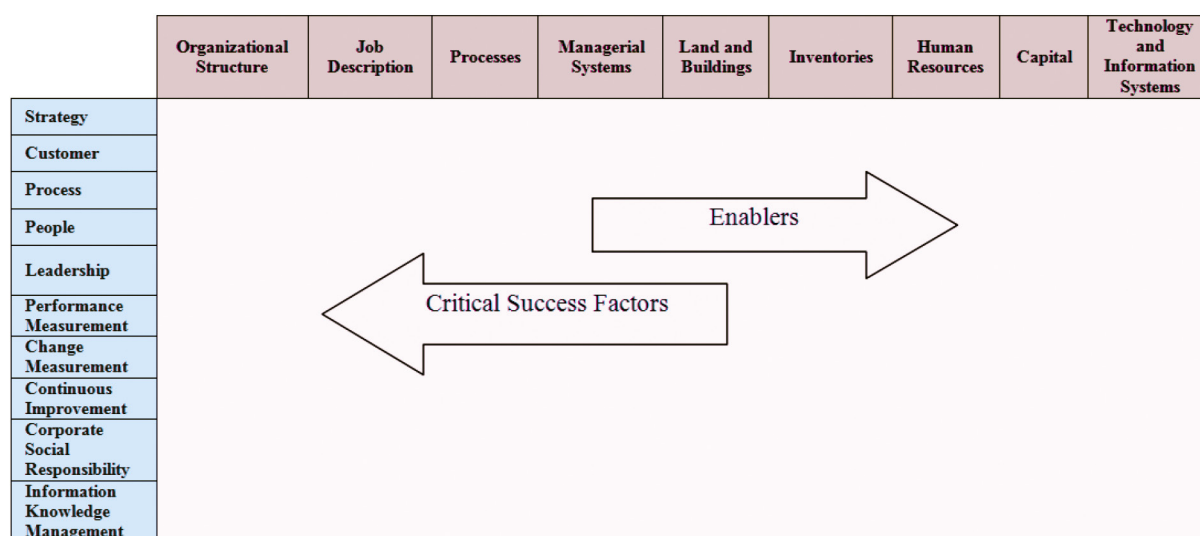


Figure 1. Glykas Quality Compass (GQC)

Accordingly, studies by Shafiqah et al. (2020), Jehangiri (2017), and Monge-Mora et al., (2020) have highlighted the need of having all the organizational resources needed to achieve the key – Critical Success Factors. Based on accounting theory and operations management as resources utilized in activity-based costing and business process costing models, Glykas Quality Compass lists six organizational resources: Land and Buildings, Equipment, Human Resources, Inventories, Capital, Information Systems, (Glykas, 2019). The aforementioned six resources and their respective four management authorities are the ten enablers of Glykas Quality Compass (GQC).

The proposed Quality Management Maturity Assessment Framework (Glykas Quality Compass, GQC) makes a clear distinction between the application of Quality Management ideas by applying maturity assessment to each of the four practices individually (Glykas, 2019). According to the study of Vitzileou et al. (2022), the proposed framework (GQC) has been applied to assess the maturity of ISO 10018:2020 implementation.

5. CONCLUSION AND FUTURE RESEARCH

In section two we presented a literature survey on the Maturity Assessment (MA) in Quality Management (QM) and on EFQM Excellence Model. After identifying research gaps and limitations and taking into consideration the reputable articles, we developed our research questions; in section three we focused our literature on the critical success factors (CSFs) in EFQM Excellence Model. A summary table of these identified critical success factors was presented. In the summary table, we highlighted the CSFs found in EFQM Excellence Model scholars to identify the most noticeable ones. In section four, we presented a Maturity Assessment Framework called Glykas Quality Compass (GQC). The holistic approach of the GQC maturity model combines CSFs with quality management principles. The members of Quality Management team can better understand the theory and link it to daily tasks thanks to GQC's holistic approach (Glykas, 2019).

This study employed Systematic Literature Review to investigate the Critical Success Factors (CSFs) affecting the successful implementation of EFQM Excellence Model. This Systematic Literature Review observes and identifies CSFs after implementing EFQM Excellence Model in organizations independent of the industry sector where the company operates. The findings indicate that CSFs vary across industries and timespans. The importance of Leadership and People as crucial CSFs is identified. This systematic literature review also identified the importance of Maturity Assessment in Quality Management.

The research aims not only to help academics and researchers in identifying Critical Success Factors in EFQM Excellence Model but also to assist practitioners in field implementation. The study also promotes the adoption of the EFQM Excellence Model and also of GQC for business excellence, and lays the foundation for further literature review studies of these two models.

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An Integrated Proposal for a Knowledge Management Implementation & Maturity Assessment Model

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Critical Success Factors;
Knowledge Management
Frameworks;
KM Performance
Measurement



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Abstract: *The goal of the paper is to suggest a comprehensive and integrated knowledge management implementation and maturity assessment model based on the most common critical success factors and corporate enablers discovered during a systematic overview of the knowledge management maturity models and the related literature review. Summarizing the review leads to the discovery of KMMs CSFs and key themes, while simultaneously examining the idea of standardization through accepted KM standards and their core principles. To provide a model that can be used by both practitioners and researchers in the future to improve organizational performance and to be used as a tool for knowledge management performance measurement, the implementation stages of the proposed framework, the maturity levels, the proposed assessment measuring tools and methods are presented in an approach that encompasses the core guidelines of ISO 30401.*

1. INTRODUCTION

Despite being intangible, knowledge is a resource that, like other resources, needs to be managed (ISO, 2015). The degree to which knowledge assets are successfully managed inside businesses is known as knowledge management (KM) maturity (Sajeva & Jucevicius, 2010). KM maturity (KMM) describes the stages of evolution of KM initiatives inside an organization (Pee & Kankanhalli, 2009). Organizational maturity models (MM) categorize processes and pinpoint phases, which guide managers' plans (Churchill & Lewis, 1983; Gaál et al., 2008).

A review of the literature on KM and KM assessment frameworks is provided in the section that follows. It was based on the most well-known reviews of the literature that examined hundreds of frameworks and thousands of papers that had been published over the previous thirty years in the field of knowledge management assessment frameworks to identify key ideas and crucial success factors in KM. The research has established the study's research goal, which is the suggestion of a brand-new, comprehensive, and integrated framework for KM Implementation & Maturity Assessment. Following that, a summary of KM-related standards is presented. The integrated KM implementation and maturity evaluation model developed by the authors is presented in the next section along with the methodology, factors, and important areas that were taken into account. Future study directions and the research's findings are presented in the paper's conclusion.

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2. LITERATURE REVIEW SUMMARIZATION

Usually, knowledge is either implicitly tacit or explicitly formalized (Massingham, 2014). The knowledge a person has in their head is known as tacit knowledge (Polanyi, 1967). Codified knowledge is the knowledge that can be transmitted using a formal, systematic language (Nonaka & Takeuchi, 1995).

The SECI (Socialization, Externalization, Combination, Internalization) Spiral of Conversion model I, as depicted in Figure 1, is a four-step process of knowledge creation including socialization, externalization, combination and internalization (Nonaka & Takeuchi, 1995).

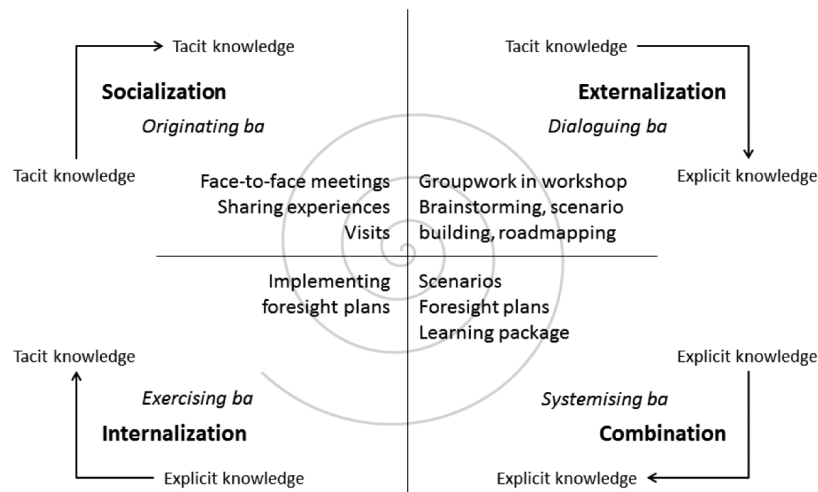


Figure 1. The SECI spiral Model

Source: Nonaka & Takeuchi, 1995.

Most of the KMM models we studied, identified key performance areas and crucial success elements relating to people, processes, and technology. Even if they do not specifically name them, the remaining KMMs make references to these elements as well. It is anticipated that these KPAs and CSFs combined can offer a thorough KM assessment.

The model should include multiple factors, as one component cannot accurately depict the overall state of knowledge management maturity within an organization because this is based on multiple key success factors (CSFs); Some variables are interconnected and context-sensitive (e.g. high quality of IT tools does not yet mean there is an adequately developed organization climate to support the use of it). Thus, the following are the eight variables that should be included in the KM maturity model: Organizational (people & organizational atmosphere and processes); Knowledge-related (acquisition, utilization, sharing and ownership); and IT-related (capturing knowledge and usage of IT tools) (Armstrong & Taylor, 2014).

Institutionalizing a training program is viewed as a top goal. Everyone inside the organization must first be made aware of the goals of knowledge management and knowledge engineering, as well as how the KM-KE program will affect them. Organizational practices such as relevant training, knowledge-sharing-enabled HR rules, and curiosity-fostering KM procedures will increase participation. Knowledge requirements and knowledge availability could be matched with the creation of user profiles that accurately reflect users' interests. A collection of HRM collaborative methods can promote knowledge.

Management must refrain from utilizing a KMMM as a tool for punishing and reprimanding underperforming units to accurately reflect reality. Instead, it needs to draw attention to any areas that require additional guidance and help. [Paulzen et al. \(2002\)](#) specifically recommend that staff members take part in the evaluation of KM maturity. One corporation took a particularly intriguing approach to measure when they disseminated "business basics" all around and at all levels as performance indicators on important activities. Business fundamentals, such as delivery, cost, customer, or people measures, are shared by all professional staff members of the organization; however, these measurements are self-driven rather than management-driven. Individuals use a straightforward grading scale to gauge their success concerning these company basics and essential processes. The organization-wide formal evaluation is then conducted every quarter concerning the business fundamentals. To provide an integrated approach to measurement across the business and a compelling example of integrating process measures with other organizational metrics, the same approach is used to track individual performance, performance against goals, and process performance ([Armistead & Machin, 1997](#)).

HR may play a significant role in knowledge management simply because people exchange information; it is not merely a matter of using IT to capture explicit knowledge. HR's responsibility is to ensure that the organization has the necessary intellectual capital. According to [Capelli and Crocker-Hefter \(1996\)](#), the resource-based view of the company emphasizes the idea that "distinctive human resource practices help to build unique competences that differentiate products and services and, in turn, promote competitiveness." HR may help by offering guidance on cultural management, organization design and development, and by setting up processes and programs for learning and communication. There are ten methods ([Armstrong & Taylor, 2014](#)) to do this:

1. Assist in creating a culture that is open and emphasizes the significance of knowledge exchange.
2. Encourage a spirit of loyalty and confidence.
3. Guide the creation and growth of organizations that support knowledge exchange through networks, collaboration, and communities of practice.
4. Offer guidance on hiring practices and resourcing services to guarantee that highly valued workers who can contribute to knowledge development and sharing are attracted to and kept on board.
5. Offer suggestions for how to encourage knowledge sharing and recognize those who do so.
6. Assist in the creation of knowledge-development and knowledge-sharing-focused performance management procedures.
7. Create organizational and individual learning mechanisms that will produce knowledge and aid in its dissemination.
8. Create and plan workshops, conferences, seminars, communities of practice, and symposia that allow for the interpersonal sharing of information.
9. Create methods for capturing and, to the extent practicable, codifying explicit and tacit knowledge in cooperation with IT.
10. In general, advance knowledge management among top managers to persuade them to take the initiative and support knowledge management programs.

Since leadership is a complex concept, many theories have been developed to try to explain it. These theories, which are outlined below in brief, have evolved and examine a variety of aspects of leadership and leadership behavior. They are complementary to one another in many ways, and collectively they contribute to a thorough grasp of what the leadership process entails. The

fundamental and, for many, most well-known theory of leadership is trait theory, which analyzes leadership in terms of the traits that effective leaders possess. But it has its limitations, and rather than concentrating on the personalities of leaders, pragmatic research was done to determine what behaviors constituted leadership. Employee as differentiated from job-centered behavior and the processes of deliberation and starting structure were identified as the two dimensions of leadership behavior, respectively, by the key leadership behavior studies done by the Universities of Michigan and Ohio State (Armstrong & Taylor, 2014).

Adair (1973) created the most compelling analysis of what leaders do. He clarified that a leader's three primary responsibilities are to: 1. Clearly state what the group is expected to perform in order to define the task in need. 2. Complete the assignment; this is the group's purpose. Leaders see to it that the group's goal is achieved. Frustration, discord, criticism, and perhaps even the group's eventual dissolution will occur if it is not. 3. Keep up strong interpersonal connections, both between themselves and other group members and within the group. If these connections help complete the task, they are effective. They can be divided into those who are interested in the team, its morale, and its sense of unity, and those who are interested in individuals and their motivations. According to Adair, the three areas of need that leaders must meet are the greatest way to articulate the demands on them. These are: 1) task needs—getting the job done; 2) individual needs—aligning one's needs with those of the task and the group; and 3) group maintenance needs—fostering and maintaining a sense of unity within the group. These requirements were modeled by Adair as three overlapping circles, as shown in Figure 2. According to this concept, the demands of the task, the individual, and the group are interrelated. Fulfilling task requirements will also fulfill group and individual requirements. However, meeting task needs requires consideration of both individual and group needs. Meeting individual needs will also help to meet group needs, and vice versa. Leaders run the risk of becoming so task-focused that they neglect the requirements of both the individual and the team or group. Being overly concerned with the demands of the individual or group at the expense of the work is just as risky. The most effective leaders are those that satisfy and balance these three needs as required by the circumstances (Armstrong & Taylor, 2014).



Figure 2. John Adair's Model of Leadership

Source: Armstrong & Taylor, 2014.

Hansen et al. (1999) recognized the codification strategy and the personalization strategy as the two knowledge management strategies. The approach to codification Knowledge is meticulously defined and kept in databases so that everyone in the company can quickly access and use it. Knowledge is formalized explicitly utilizing the "people-to-document" method. Consequently,

the strategy is document-driven. Knowledge is taken from the creator, created independent of the creator, and then utilized for different purposes. It lets users search for and obtain codified knowledge without having to get in touch with the person who created it because it is preserved in an electronic repository for public use. In order to manage databases, this method heavily relies on information technology and the intranet. Personalization tactics Knowledge is transferred mostly through direct person-to-person interactions and is tightly linked to the person who generated it. This "person-to-person" method entails facilitating the transmission of tacit knowledge. By fostering networks and encouraging face-to-face interaction between individuals, the exchange is accomplished through unofficial conferences, seminars, communities of practice, brainstorming sessions, and one-on-one meetings. The choice of strategy, according to Hansen et al. (1999), should depend on the organization, including what it does and how it does it. Therefore, firms like Ernst & Young that use knowledge to solve recurring issues may rely on codification to make recorded solutions to related issues accessible. However, strategy consulting firms like McKinsey or Bain rely on a personalization strategy to enable them to deal with the complex strategic issues that they are presented with and that necessitate the supply of original, meticulously researched recommendations. They must locate and nurture individuals who can employ a person-to-person knowledge-sharing technique in order to channel individual expertise. It is possible to locate experts who can be contacted via phone, email, or in person. According to the study by Hansen et al. (1999), businesses that effectively utilize knowledge employ one of the two strategies—personalization or codification—as their primary approach and complement it with the other. They noted that those who attempt to be outstanding at both techniques run the danger of failing at both (Armstrong & Taylor, 2014).

When it comes to infrastructure and Knowledge Management Systems, the following steps should be followed (Armstrong & Taylor, 2014) at the starting implementation phase:

1. Creating an intranet,
2. Creating 'data warehouses',
3. Using decision support systems,
4. Using 'groupware', i.e. information communication technologies such as e-mail or discussion bases,
5. Creating networks or communities of practice or interest of knowledge workers.

3. STANDARDIZATION IN KNOWLEDGE MANAGEMENT

Organizational knowledge management was introduced on September 15 of 2018 to the followers of ISO 9001 as KNOWLEDGE MANAGEMENT RESEARCH & PRACTICE 3: 7.1.6, *organizational Knowledge – The organization shall determine the knowledge necessary for the operation of its processes and to achieve conformity of products and services. This knowledge shall be maintained and be made available to the extent necessary. When addressing changing needs and trends, the organization shall consider its current knowledge and determine how to acquire or access any necessary additional knowledge and required updates* (ISO, 2018).

Long before that, the European Committee for Standardization published The European Guide to Good Practices in Knowledge Management (CEN-CWA 14924-1, 2004). The five main knowledge-related actions outlined in the Guide are: a) Identify knowledge; b) Create (new) knowledge; c) Store knowledge; d) Share knowledge; and e) Use knowledge, according to Weber (2002). Two essential requirements must be addressed in order to improve the outcomes of these basic knowledge activities. Aligning or integrating the core activities into ordinary tasks

and organizational procedures is the first stage. The fundamental operations must be adequately balanced to account for the distinctive qualities of each business process and organization, which is the second stage.

The knowledge management system standard ISO 30401 adopts a process-centric approach to knowledge. This is why it's crucial to have it developed, consolidated, retained, shared, adapted, and applied so that employees may make informed judgments and take coordinated action, addressing difficulties based on previous experience and novel future insights (ISO, 2018). The management of knowledge, according to ISO 30401, necessitates valuing many knowledge-related factors, such as the knowledge's nature (which is intangible, complex, and human-created), value, focus (on organizational goals, strategies, and needs), adaptability, shared understanding, environment, culture, and interactivity (Zeferino et al., 2020).

4. MODEL PROPOSAL AND METHODOLOGY

Through the literature survey which included case studies publications, the following key points were identified:

- Human resources, processes and technology enablers have been identified as primary factors and enablers in the prominent literature. The People – Process – Technology three-fold perspective is the most commonly encountered and referenced in KM theory and KM frameworks.
- Leadership may be a factor not so much encountered in literature and case studies results, however, it is the core principle defined by ISO 30401, around which all KM concepts and steps evolve.

The GQC spider-web version KM model that the authors designed (Bougoulia & Glykas, 2022) shown in Figure 3, takes into account the following literature and methodology milestones and presented a draft for a model basis:

1. The Tacit – Explicit Knowledge distinction combined with
2. The SECI (Socialization, Externalization, Combination, Internalization) spiral model for continuous improvement
3. The People – Process – Technology three-fold perspective
4. The existing KM frameworks CSFs: Human resources, Process, Technology, Leadership, Customer focus, Strategy, Performance Measurement, Change Management and Continuous Improvement
5. The Leadership – cored cycle of the ISO 30401.

In this approach, the Outward phase represents the implementation stages and the Inward phase represents the maturity assessment process. Thus, it allows for the same stages to be used in a complementary fashion. The two phases can stretch over one year, for example, implementing practices can be the focus for nine months, followed by three months of assessing the results and the maturity. This also allows for repetitiveness to achieve optimal levels, year after year.

Another key point of the proposed “Outward – Inward” approach model, which is depicted in Figure 4, is that it allows for an organization to be at a different implementation stage or assessment level for each of the eight factors that represent the eight axes that form the framework’s guidelines. However, leadership, which is the core of the model proposal, must be involved at all times in every implementation stage and assessed respectively during the 3-month assessment period.

Given that knowledge management is highly related to and dependent on Information Technology, the CMM's implementation stages are an optimal fit to encompass the respective stages in this research's proposed model, as this model is previously described. The five implementation stages: 1. Initial 2. Managed 3. Defined 4. Quantitatively Managed 5. Optimizing can also be used in a reverse inward approach, as the maturity assessment levels for each of the eight key areas of the proposed framework: 1. People 2. Technology 3. Process 4. Change management – Continuous improvement 5. Strategy 6. Communication 7. Customer focus 8. Performance Measurement is always weighted by the Leadership implementation/ assessment factor, as shown in Figure 5.

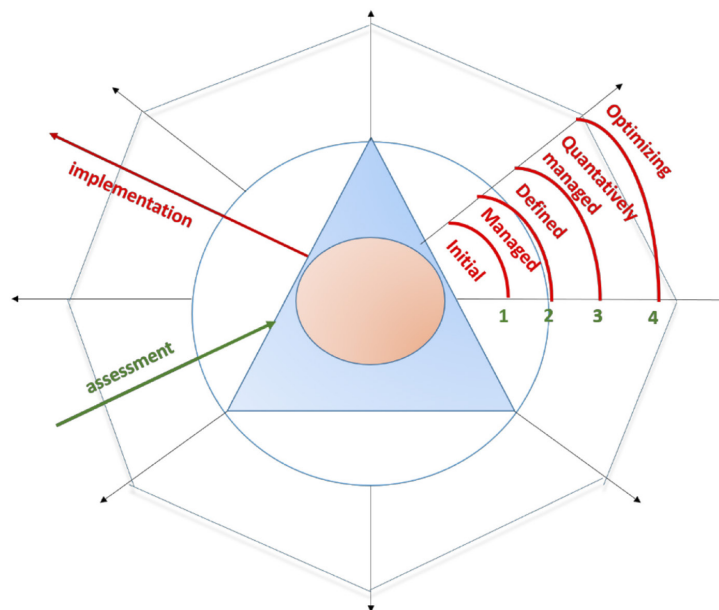


Figure 5. The maturity levels of the proposed model

To find the major knowledge gaps and the essential information needed to offer high-quality products and services, an organizational knowledge audit, benchmarking, and strategy are also necessary. There must be a system in place for keeping information and making it available at the necessary level, including roles, procedures, and enabling technology (ISO, 9001). The one-year repeated cycle that is proposed in this research's model, allows for the annual maturity assessment results to be used as a benchmarking basis while at the same time, being taken into account while redesigning strategy and goals for the next year's implementation stages. The basic knowledge management tool-kits of the ISO 9001, are considered a fundamental aspect of the model.

According to the APQC, the American Productivity and Quality Center, founded in 1977 and one of the world's foremost authorities in benchmarking, best practices, process and performance improvement, and knowledge management, measurement has always been contentious in knowledge management. Some knowledge managers claim that anecdotal evidence is more persuasive than data and that it would be wiser to invest the time required to calculate KM's business impact in enhancing the organization's KM services. But APQC strongly advises in favor of it despite the difficulties involved in quantifying something as intangible as KM. Some of the explanations are as follows:

- By being truthful about the objectives an organization seeks to achieve, measurement reminds managers of what's most crucial and stops them from deviating from the broad vision outlined in the KM business case,
- Before measurable results being apparent, measures show progress throughout the early phases of a KM deployment,

- Data helps managers recognize problems and course-correct when a KM tool or approach is not working as planned,
- Less involved groups are revealed through analysis, allowing managers to create focused tactics to raise awareness and spur involvement,
- The KM program will be better protected amid upcoming organizational changes or cost-cutting initiatives if a KM manager can provide evidence of KM's impact on the business.

The knowledge management metric that APQC uses shows a variety of evaluation methods, as shown in Figure 6. Most businesses use leaders' and users' feedback, success stories, and other anecdotal evidence to show how KM benefits the organization. To establish whether their target audiences are being reached and their goals are being achieved, the majority of people evaluate KM's performance using activity and satisfaction measures. Business impact and ROI indicators are less popular.

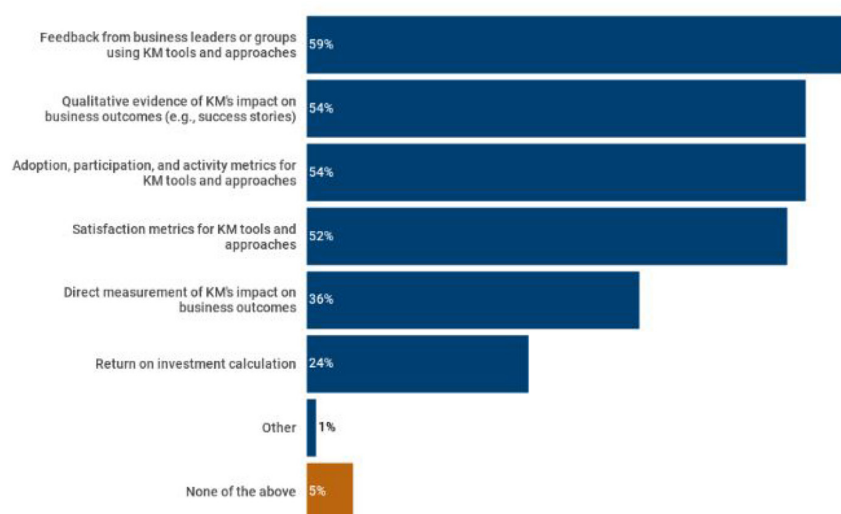


Figure 6. Methods used to evaluate KM program Performance

Source: APQC.org

While business value and impact metrics are less common than other types of evaluation, KM programs that employ these techniques frequently receive higher evaluations from decision-makers and more substantial financial support. Decision-makers tend to give KM initiatives that employ these techniques higher ratings and stronger financial backing.

It should come as no surprise that KM teams who directly link knowledge sharing and reuse to the bottom line find it simplest to secure the funding required to maintain and grow their programs. Programs that assess cost savings via KM are more likely to anticipate having their next budget approved easily or very easily among KM initiatives that track business value indicators. Similar to this, KM initiatives that link KM efforts to rising sales are more likely to anticipate an easy budget approval. But non-financial metrics of business effect, such as cycle time reductions, time savings, and quality enhancements, seem to be equally important in boosting executives' faith in KM and persuading them that it is serving the intended purpose.

Based on the previous observations, the basis of the proposed model assessment methodology is that the overall maturity level of an organization will be an overall total of weighted averages,

in the sense of metrics. Within this measurement system, Leadership will be the one and only Constant, and its relationship with all other measured factors will always be integrated into the measurement process. People, Process and Technology are the factors that carry the highest weight in metrics. And most importantly, the metrics will not measure absolute factors, but the relationship between them, as shown in Figure 7. The relationships formed will be the proposed KPIs for the KM maturity assessment model.

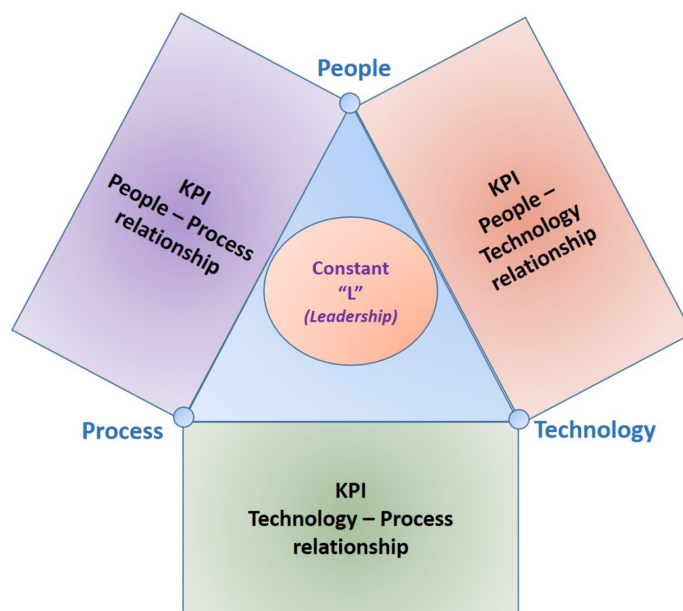


Figure 7. The proposed model's assessment methodology approach

In that sense, the most weighted 3 relationships, are the:

- People – Process relationship (“PP”),
- People – Technology relationship (“PT”),
- Technology – Process relationship (“TP”).

The relationships of the Constant “Leadership” that need to be established and measured are:

- People – Leadership (“L1”),
- Process – Leadership (“L2”),
- Technology – Leadership (“L3”).

The proposed KPIs to measure the performance of the 3 crucial assessment relationships are formed as follows, attributing a weighing factor of “2” to the Grades regarding People, Process and Technology:

1. $KPI(1) = \text{“People – Process”} = \{2 \times (PP)\} \times CL1$, where
 $CL1 = \text{“People – Leadership”} + \text{“Process – Leadership”} = L1 + L2$
2. $KPI(2) = \text{“Technology – Process”} = \{2 \times (TP)\} \times CL2$, where
 $CL2 = \text{“Technology – Leadership”} + \text{“Process – Leadership”} = L3 + L2$
3. $KPI(3) = \text{“People – Technology”} = \{2 \times (PT)\} \times CL3$, where
 $CL3 = \text{“People – Leadership”} + \text{“Technology – Leadership”} = L1 + L3$.

An Index Table (1) for these relationships is provided below:

Table 5. Index Table for the Crucial KPIs of the proposed KMMM

	People	Process	Technology	Leadership
People	<i>x</i>	<i>PP</i>	<i>PT</i>	<i>L1</i>
Process	<i>PP</i>	<i>x</i>	<i>TP</i>	<i>L2</i>
Technology	<i>PT</i>	<i>TP</i>	<i>x</i>	<i>L3</i>
Leadership	<i>L1</i>	<i>L2</i>	<i>L3</i>	<i>x</i>

These aforementioned weighed relationships of CS factors (People – Process, People – Technology, Technology – Process), the Constant Relationships (People – Leadership, Process – Leadership, Technology – Leadership) thus forming the three most important Key Performance Indicators for the proposed Knowledge Management Maturity Assessment matrix.

The matrix provides the remaining relationships that should be assessed during the Inward phase of the KM maturity assessment. Those relationships examine the integration of the remaining defined CSFs: Strategy, Communication, Customer focus, Change Management, Continuous Improvement and Performance Measurement:

- Strategy – People (“SP”)
- Strategy – Technology (“ST”)
- Communication – People (“CP”)
- Communication – Technology (“CT”)
- Customer Focus – Technology (“CFT”)
- Customer Focus– Process (“CFP”)
- Change Management – Process (“CMPr”)
- Change Management – People (“CMPe”)
- Continuous Improvement – Process (“CIPr”)
- Continuous Improvement – People (“CIPe”)
- Performance Measurement – Process (“PMPr”)
- Performance Measurement – People (“PMpe”).

The relationships of the Constant “Leadership” remain the same, as before:

- People – Leadership (“L1”),
- Process – Leadership (“L2”),
- Technology – Leadership (“L3”).

The proposed KPIs to measure the performance of these 12 secondary assessment relationships are formed as follows, attributing a weighing factor of “1” to the Grades regarding Strategy, Communication, Customer focus, Change Management, Continuous Improvement and Performance Measurement:

1. KPI (4) = “Strategy - People” = (SP) x (L1)
2. KPI (5) = “Strategy - Technology” = (ST) x (L3)
3. KPI (6) = “Communication - People” = (CP) x (L1)
4. KPI (7) = “Communication - Technology” = (CT) x (L3)

5. KPI (8) = “Customer Focus - Technology” = (CFT) x (L3)
6. KPI (9) = “Customer Focus - Process” = (CFP) x (L2)
7. KPI (10) = “Change Management - Process” = (CMP_r) x (L2)
8. KPI (11) = “Change Management - People” = (CMP_e) x (L1)
9. KPI (12) = “Continuous Improvement - Process” = (CIP_r) x (L2)
10. KPI (13) = “Continuous Improvement - People” = (CIP_e) x (L1)
11. KPI (14) = “Performance Measurement - Process” = (PMP_r) x (L2)
12. KPI (15) = “Performance Measurement - People” = (PMP_e) x (L1).

An Index Table (2) for these KPIs and their relationship to the crucial KPIs and Constants is provided below:

Table 2. Index Table for the secondary KPIs of the proposed KMMM

	People - Process "PP"	People - Technology "PT"	Technology - Process "TP"	Leadership	KPI
Strategy		SP, ST		L1, L3	KPI (4), KPI (5)
Communication		CP, CT		L1, L3	KPI (6), KPI (7)
Customer Focus			CFT, CFP	L2, L3	KPI (8), KPI (9)
Change Management	CMP _r , CMP _e			L1, L2	KPI (10), KPI (11)
Continuous Improvement	CIP _r , CIP _e			L1, L2	KPI (12), KPI (13)
Performance Measurement	PMP _r , PMP _e			L1, L2	KPI (14), KPI (15)

The metrics spreadsheet for the early implementation stages of the proposed KM implementation and maturity assessment framework is presented in Table 3.

5. FUTURE RESEARCH DIRECTIONS

The study found a gap in two distinct areas. First off, there aren't any actual case studies or implementation projects because the Knowledge Management ISO Standard 30401 is still rather new. Given the widespread demand for KM methods in contemporary firms, this will undoubtedly alter shortly. Results from the use of the Standard are anticipated to offer a better and more comprehensive insight regarding the performance measurement related to KM.

Second, the research revealed a need for a comprehensive strategy for KMMMs, one that could be used in all shapes and sizes of businesses, and this paper set out to fill that need.

6. CONCLUSION

This study sought to develop a comprehensive and integrated methodology for knowledge management maturity assessment. A system made up of steps, literary milestones and questions was created to achieve this main goal.

Table 3. The metrics spreadsheet for the proposed KMMM

Aspect	Area	Metrics Indicator	Toolkit
People - Process "PP"	<i>Awareness</i>	1. Number of customized user profiles created 2. To what degree the management's goals have been made public	Internal audit
	<i>Participation</i>	1. Hours spent on KM meetings and events 2. Number of employees that participate within a year in KM approaches and activities	Log-in data Internal audit
	<i>Sharing</i>	1. Number of processes shared 2. To what degree employees feel comfortable in sharing their knowledge to help others	Log-in data Internal audit Survey
	<i>Contribution</i>	1. Number of new processes created and documented	Internal audit
	<i>Performance</i>	1. To what degree employees feel that they saved time in everyday routines	Survey
	<i>Satisfaction</i>	1. To what degree are the employees satisfied with new processes	Survey
<i>CL1</i>	<i>Leadership</i>	1. Hours of KM meetings and events 2. Number of new performance goals	Internal audit
People - Technology "PT"	<i>Involvement</i>	1. Hours spent using knowledge in KMSystems 2. To what degree employees feel that participation generates experience and contribution	Log-in data Survey
	<i>Usability</i>	1. Percentage change in time savings attributed to KM 2. To what degree the users consider knowledge in databases useful 3. To what degree the users re-use knowledge	Management data Survey
	<i>Sharing</i>	1. Number of returning users in databases 2. Errors reported by employees or detected during audit	Log-in data Survey Internal audit
	<i>Efficiency</i>	1. Percentage change in cycle time reduction from projects/ processes attributed to KM	Management data
	<i>Training</i>	1. Number of organized KMS workshops 2. Hours spent on KMS testing	Internal audit Log-in data
	<i>Satisfaction</i>	1. To what degree are the employees satisfied with new technologies	Survey
<i>CL3</i>	<i>Leadership</i>	1. Funds for KM meetings, trainings, events, and workshops 2. Number of new strategic goals	Management data Internal audit
Technology - Process "TP"	<i>Knowledge Structure</i>	1. Number of accesses in defined areas and processes 2. Number of returning users in databases	Log-in data
	<i>Usability</i>	1. To what degree employees experience saved time in finding information in databases	Survey
	<i>Contribution</i>	1. Number of new processes created and documented in KMS 2. Number of solutions created	KMS data
	<i>Quality</i>	1. Number of succes stories 2. Number of lessons learned	Log-in data Internal audit
	<i>Efficiency</i>	1. Average time of resolution	KMS data
	<i>Improvement</i>	1. Number of processes that were declared obsolete or updated	KMS data Internal audit
<i>CL2</i>	<i>Leadership</i>	1. Funding of KM applications, platforms and technologies 2. Number of new customer focus goals	Management data Internal audit

This paper presented the findings of the method research and the results of the literature survey. This research led to the identification and recording of KMMMs CSFs and KM important points. The idea of standardization and its connection to knowledge management was summarized, along with recognized KM Standards and their fundamental ideas. Although there are many publications on knowledge management, there is a lack in the literature when it comes to case studies that relate to KM Standards. This discrepancy can be mostly explained by the ISO 30401 's recent publication and completion of its three-year pilot implementation cycle, which is normal for newly created Standards.

The research objective of the study was expanded to include the recommendation of a comprehensive and integrated framework for knowledge management maturity assessment that incorporates the fundamental principles of ISO 30401 and can be used by both academics and industry professionals.

A proposal for such a model was then presented, using the newly introduced authors' definition of an “Outward – Inward” combination approach to use the same model as an Implementation Framework and a Maturity Assessment Model. The web-like relationships between factors, enablers and KM aspects can be used as a Knowledge Management Maturity Assessment model's parameters, constants and KPIs.

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Human Resources Cost of Quality Conformance: A Process Mining Effort-Based Application for a Fruit Canning Company

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Abstract: *Quality is the main factor that contributes decisively to the achievement of business goals and objectives. However, quality improvement leads to increases in production costs. Organizations, therefore, make a comparison between the business benefits and the associated quality costs in any quality improvement initiative. Even though the calculation of quality costs has become a prerequisite for quality implementation initiatives our literature survey has revealed that existing accounting frameworks present serious drawbacks in the calculation of human resources costs associated with activities performed by individuals that are directly related to the design and implementation of quality management systems. In our research, we concluded with an Integrated Quality Cost Accounting framework, based on the combination of the following approaches: Activity Based Costing, Process-Operations Mining, Human Resource Accounting, and Cost of Quality (CoQ).*

1. INTRODUCTION

In the 21st century, the concepts of value and risk have acquired particular importance in the study of management. Although the concept of value (in the sense of utility) is not new, however, value management in the value chain or flow is a recent development that was born alongside the Porter and Advantage value chain (1985) and was significantly strengthened in the 90s, with the introduction of lean management models. Similarly, while risk definition and management are not new concepts for businesses, they nevertheless came to the surface after major events such as: the global financial crisis of 2008, the multiple product safety recalls, fears, high-profile frauds and fraud in the supply chain, as well as the consequent increase in interest in supply chain risk management. The impact of the COVID-2019 pandemic on supply chains in addition to the COVID-2019 pandemic will make risk management the highest management priority in quality management (QM) (Grigg, 2020).

In the modern global market, entrepreneurs are faced with extremely complex and competitive conditions (Psomas et al., 2018), due to the internationalization of markets, the rapid development of technology and the changing socio-political and economic environment. For this reason, the interest of researchers and entrepreneurs is focused on the concept of quality costs (Dimitrantzou et al., 2020; Psomas et al., 2018).

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Although the concept of quality cost was introduced in the 1950s by Juran, in 1956 Feigenbaum further categorized costs into the following categories: prevention, evaluation and failure (PAF); however, very few studies have been conducted to measure CoQ. In the international literature, there are still question marks as to how to calculate in detail all components of the CoQ dimensions, i.e., there is limited research describing how CoQ information is used in the management process (Psomas et al., 2018).

2. COST OF QUALITY (COQ) – OBJECTIVES

A plethora of definitions have been attributed over time to Quality Cost (CoQ), since there is no general agreement on a single broad definition, resulting in different definitions in different disciplines and among researchers. A large number of different terms have been used to analyze the term 'quality cost', such as 'quality economy', 'non-compliance price' (PoNC) or 'poor quality costs'. However, a generally accepted definition includes "the cost of all the efforts a business makes to provide a product that meets the needs and requirements of customers". CoQ shares the monetary expression of the efforts undertaken by the company to ensure the intended levels of quality (Psomas et al., 2018). While by a broader definition, quality costs are called "the costs associated with the design, implementation, operation and maintenance of a quality management system, the cost of resources from continuous improvements, the cost of system failures, product and service, and the costs of activities with no added value, but essentially required to provide a product or service of acceptable quality" (Sawan et al., 2018).

By definition, quality costs are a commonly used term but often misunderstood. It is not always the price of creating a quality product or service. However, it is the cost of not adding value due to errors and poor management practices, such as re-processing, rechecking, and correcting errors. The idea of quality cost was developed in the 50s as a tool of management, which will evaluate the improvement of quality and contributions to profits. There are two categories: **good quality cost**, which includes **prevention costs**, and **poor-quality costs**, which includes the **cost of internal** and **external failure** (Aoun & Alaaraj, 2019).

Quality cost (COQ) is therefore understood as the total cost arising from the quality control process and the cost of the defect of the product. Estimating COQ is an essential step towards achieving competitiveness because these costs are closely linked to the company's annual revenues. One of the most important categories of such costs is the external failure costs, from which claims against a guarantee may arise. COQ affects operating costs, profitability and consumer needs. Higher product quality standards have been a trend among world-renowned manufacturers since the 60s, while COQ makes up about 30% of the total cost of production (Teli & Murumkar, 2018).

Quality costs are divided into two categories: **audit costs** which are also referred to as **compliance costs** and **costs of failure of control** or **non-compliance costs**. Control costs are costs incurred in ensuring quality, while non-control costs are costs incurred due to a lack of quality and safety. **Control costs** are divided into **prevention** and **evaluation costs**, while **non-control costs** are divided into **internal failure** and **external failure costs** (Figure 1). The cost of audit failure (the hidden cost of lack of quality) is significant and usually under-represented when budget decisions are made (Donnelly et al., 2018).

The purpose of quality costs is to link quality improvement to customer satisfaction, as well as to correlate quality improvement activities with a cost. The above concept is known as the pairing of reduced costs with increased benefits for quality improvement (Figure 2) (Sawan et al., 2018).

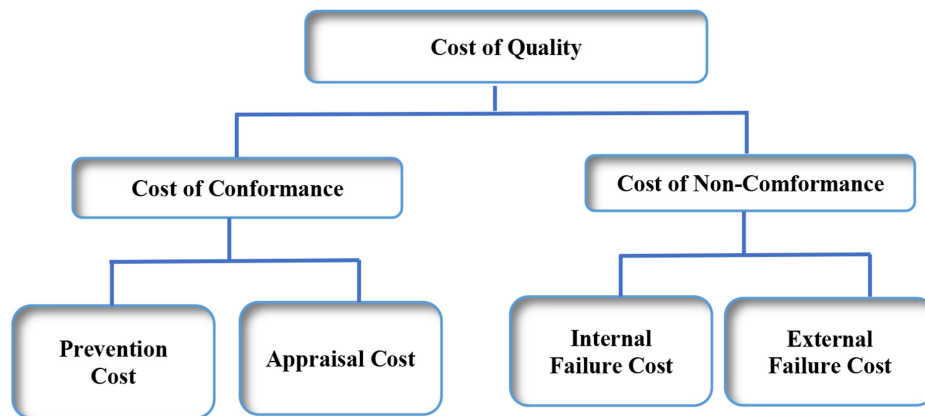


Figure 1. Classification of Cost of quality

Source: Kumar et al., 2020

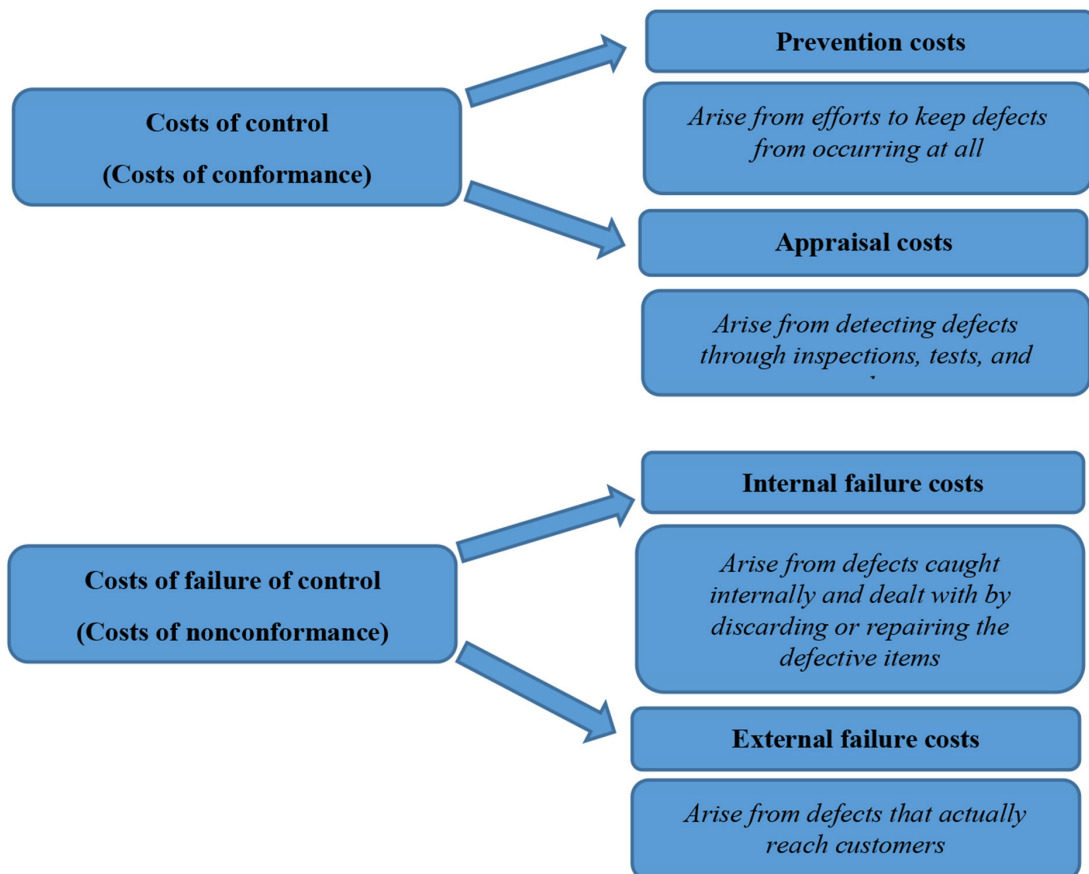


Figure 2. The categories of the costs of quality

Source: Donnelly et al., 2018

The objectives of a CoQ system are: a) the overall improvement of quality, b) the identification of cost reduction targets and assessment of progress, c) the improvement of strategic plans, d) the evaluation of the quality system and d) the motivation of employees (Teli & Murumkar, 2018). Table 1 below shows the Cost of Quality for various sectors.

Table 1. Quality costs for various sectors

	Health care organizations	Supply chain	Quality planning
Prevention cost	▪ Salaries and benefits for staff	▪ Recruiting	▪ Quality planning
	▪ Training	▪ Training	▪ Training
	▪ Quality planning	▪ Auditing	▪ Design review
	▪ Preventive maintenance contracts for equipments	▪ Supplier certification	▪ Design, development and installation of quality measurement and test equipment
	▪ Office supplies for documentation and annual	▪ Supplier assurance defects	▪ Quality improvement programs and quality engineering
		▪ Redesign	
		▪ Rework	
Appraisal cost		▪ Reinspection of reworking	
		▪ Retesting and Scrap	
	▪ Quality control	▪ Inspection of material	▪ Quality inspection
	▪ Verification	▪ Prototype inspection	▪ Product testing
	▪ Supplier rating	▪ Quality auditing	▪ Performing audits to meet quality standards
	▪ Quality audits	▪ Outgoing inspection	▪ Equipment used for quality appraisal
	▪ External Quality Assurance (EQA) surveys	▪ Equipment tests & calibration.	▪ Worker time spent on measuring quality
Internal failure Cost		▪ Production control.	
	▪ Wastes at inventory level	▪ Downtime caused	▪ Identify faulty good
	▪ Reeducating staff.		▪ Reworking of defective units
	▪ Repeat ion of tests		▪ Downtime caused by quality problem
	▪ Data entry errors		▪ Waste due to poorly designed processes
External failure cost			▪ Costs associated with failure analysis
	▪ Warranty expenses	▪ Downtime caused	▪ Liabilities from legal actions/penalties
	▪ Complaints		▪ Repairs and Replacements
	▪ Delay in reporting test results to clients		▪ Loss of goodwill
			▪ Lost business
			▪ Loss of market share
			▪ Product recall
			▪ Warranty work

Source: Ocakci et al., 2021

However, there was a misconception that achieving better quality would be more expensive and would make production more difficult. This myth prevented many businesses from investing in CoQ-related programs. An optimal quality improvement policy compensates for the minimization of CoQ and the maximization of the quality of compliance, to achieve high quality most economically (Psomas et al., 2018).

3. TYPES OF POOR QUALITY OR QUALITY COST

The cost of poor quality is defined as "the total cost arising from the execution of the employee's actions to do his job properly each time, as well as the cost of determining the acceptance of the product, plus any costs, resulting from the non-compliance of the product with the required specifications and expectations of customers". Figure 3 below illustrates the poor-quality cost items (Teli & Murumkar, 2018).

In general, four categories of quality costs, which are emphasized by many companies, are described as follows:

- **Prevention costs:** these costs are related to the design, implementation and maintenance of the quality management system. Prevention costs are planned and incurred before the actual operation. Some examples of prevention costs are: quality planning and certification, supplier competence surveys, process capacity assessments, quality education and training, etc. (Akenbor, 2014; Psomas et al., 2018). It is the cost of all activities that prevent the poor quality of the products or services (Teli & Murumkar, 2018).

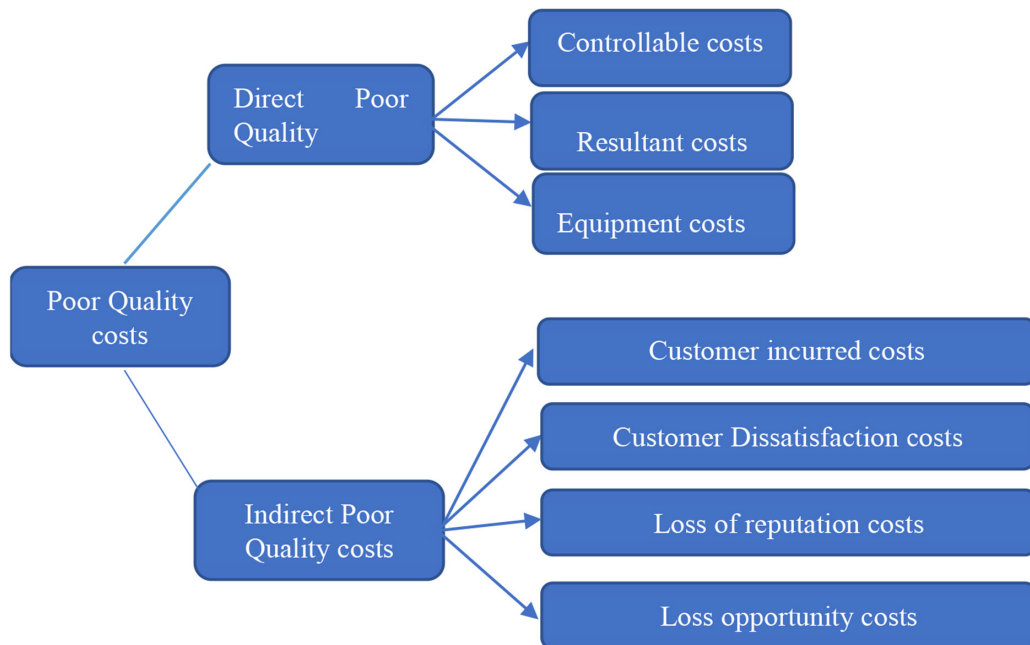


Figure 3. Direct and Indirect Cost components

Source: Teli & Murumkar, 2018

- **Estimation costs:** these costs are related to the measurement – evaluation of purchased materials, processes, intermediate and finished products and services, to ensure compliance with the specified requirements. Some examples of evaluation costs are: the cost of incoming, in-process and final inspections/tests, product and process audits, calibration of measuring and testing equipment, etc. (Akenbor, 2014; Psomas et al., 2018; Teli & Murumkar, 2018).
- **Internal failure costs:** these costs arise when the results of the work fail to reach quality standards, while these failures are detected before the transfer to the customer takes place. It is created before the delivery of the products or the provision of services to the customer. Some examples of internal failure costs are: the cost of re-treatment, re-inspection-re-inspection, retesting of route revision and degradation, machine outages, etc. (Akenbor, 2014; Psomas et al., 2018; Teli & Murumkar, 2018).

- **External failure costs:** are the costs incurred when the products or services fail to reach quality standards, while these failures are detected only after the products or services have been transferred to the customer. The cost of failure arises after the delivery of the products or services to the customer. Some examples of external failure costs are: the cost of processing customer complaints, customer returns, warranty claims, product recalls, or replacement, compensation payments to the customer, etc. (Akenbor, 2014; Psomas et al., 2018; Teli & Murumkar, 2018).

Quality costs are incurred by the customer or displayed when a product does not meet customer requirements. Some of them are: loss of productivity when the equipment is put out of service, travel expenses and return time of a defective product and repair costs after the warranty period has expired (Teli & Murumkar, 2018).

Customer dissatisfaction (PQC) lies in customers' demands for a better product in order to meet their expectations and requirements. While manufacturing their products to the specifications, there is the possibility that businesses may not be good enough to retain their customers or attract new ones. Awareness of the volatility of customer expectations and the constant reintroduction of standards is a one-way street for businesses to maintain market share (Teli & Murumkar, 2018).

While the **loss of reputation (COQ)** and CoQ's work strategies are difficult to quantify, it is also difficult to quantify the causes of customer dissatisfaction and COQ charges from the customer. Expenses incurred due to loss of reputation, change or increase from the cost of customer dissatisfaction since they depend on customers (Teli & Murumkar, 2018).

4. QUALITY COSTING MODELS

In the existing literature, several models can be found regarding the classification and handling of quality costs. Table 2 is an overview of the models.

Table 2. Generic COQ Models and Cost Categories

Quality Cost models	Category of quality costs
PAF model (Prevention-Appraisal-Failure)	Prevention, Appraisal + Failure
Crosby's model	Cost of conformance + cost of non-conformance
Opportunity cost model	Prevention+Appraisal+Failure+Opportunity cost
Surcharge calculations	Material, manufacturing, supply, administration, sales, overheads
Activity-based costing	Process cost of production

Source: Teli & Murumkar, 2018; Ocakci et al., 2021

The "Prevention-appraisal-failure" (PAF) quality costing model is one of the most prevalent in quality costing, proposed by Juran in 1951 (Figure 4) and Feigenbaum in 1956, in which it categorizes CoQ into prevention, estimation and failure costs. The failure cost is then further classified into two sub-dimensions, i.e., internal failure costs and external failure costs (Psomas et al., 2018; Sawan et al., 2018).

Ross (1977) developed the process cost model, which was first used by Marsh (1989) for quality costing and represents quality cost systems that focus on the process rather than services or products. The cost of the procedure is the total cost of compliance and non-compliance of a process.

This model was proposed for quality costing, in the context of total quality management (TQM), because it recognizes the importance of estimating process costs and ownership and represents a more integrated approach to quality than the RAF model (Teli & Murumkar, 2018).

The Crosby model, introduced by Crosby (1979), is an alternative PAF approach. Based on this model, quality is defined as "compliance with requirements", while non-compliance means failure to do things right the first time. The price of compliance is the cost of ensuring that things are done correctly the first time, which includes the actual costs of prevention and evaluation, while the cost of non-compliance is the money wasted when the work fails to comply with customer requirements and is usually incurred by quantifying the cost of correction, re-treatment or dissolution, corresponding to the actual failure cost (Psomas et al., 2018; Sawan et al., 2018).

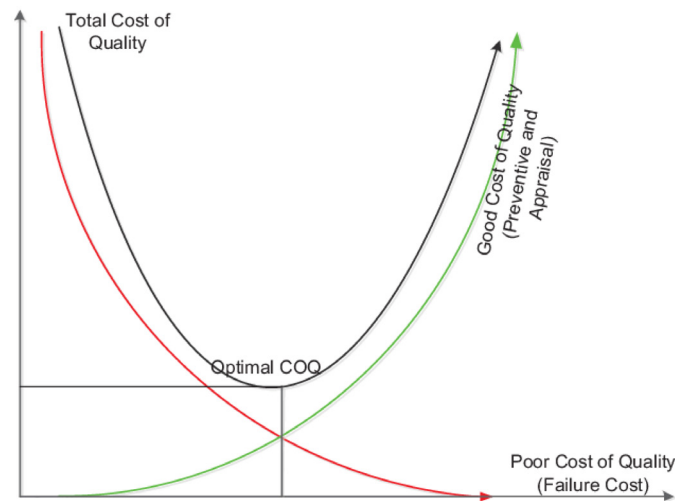


Figure 4. Juran's first model of CoQ

Source: Makhanya et al., 2018

The further development of the COQ methodology is attributed to Tsai (1998), who proposed a comprehensive framework for measuring COQ called Activity-Based Costing (COQ-ABC). In this model, Quality Costing and Activity-Based Costing merge and share a common database to provide various cost and non-financial information on relevant management techniques (Teli & Murumkar, 2018).

Subsequently, Plunkett and Dale (1988) stressed the importance of including intangible and opportunity costs when taking into account the costs of poor quality. Pursglove and Dale (1995) suggested another approach to COQ analysis, where the focus is on identifying all costs related to everything that has gone wrong in a process (Figure 5) (Sawan et al., 2018).

Alglawe et al. (2019) proposed the quality costing model (COQ) using the System Dynamics approach based on the traditional prevention-evaluation-failure (RAF) concept. In this model, opportunity costs were incorporated into the quality cost accounting calculations in order to build a framework for the behavior of all quality cost factors in the supply chain. From their conclusions, it follows that when taking into account opportunity costs in a COQ model, the number of new customers and production units in the supply chain decreases, which emphasizes the importance of opportunity cost analysis in making strategic quality management decisions (Alglawe et al., 2019).

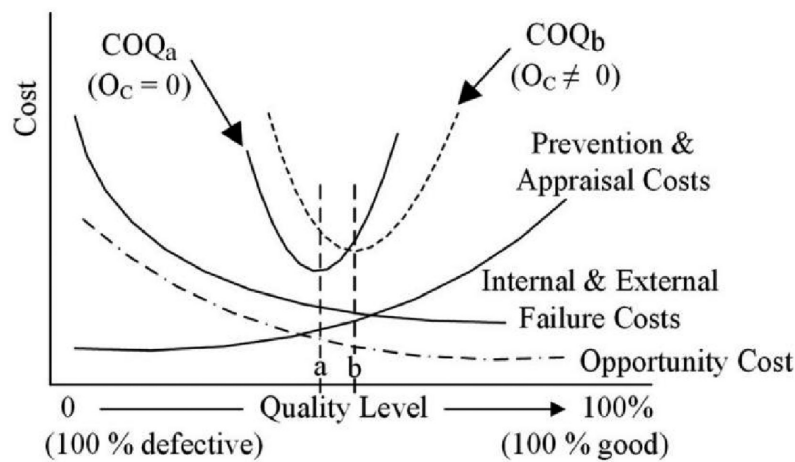


Figure 5. COQ before and after incorporating OC

Source: Alglawe et al., 2019

Ocakci et al. (2021) proposed a holistic activity-based quality cost model approach to production, covering internal production and the entire supply chain, from the supply of materials to the fulfillment of all contractual obligations ending with the delivery of the finished products to the customer (including the possible warranty and replacement in case of non-supply compliance). According to this concept, quality-oriented supplier management includes not only price negotiation but also covers aspects related to the quality of supplier selection, reducing material and process costs, maintaining and improving the quality of materials and processes, evaluating supplier performance, and developing the supplier over time. Figure 6 depicts the entire supply chain for the activities in a production process, starting from the supply to the delivery of finished products to the customer (Ocakci et al., 2021).

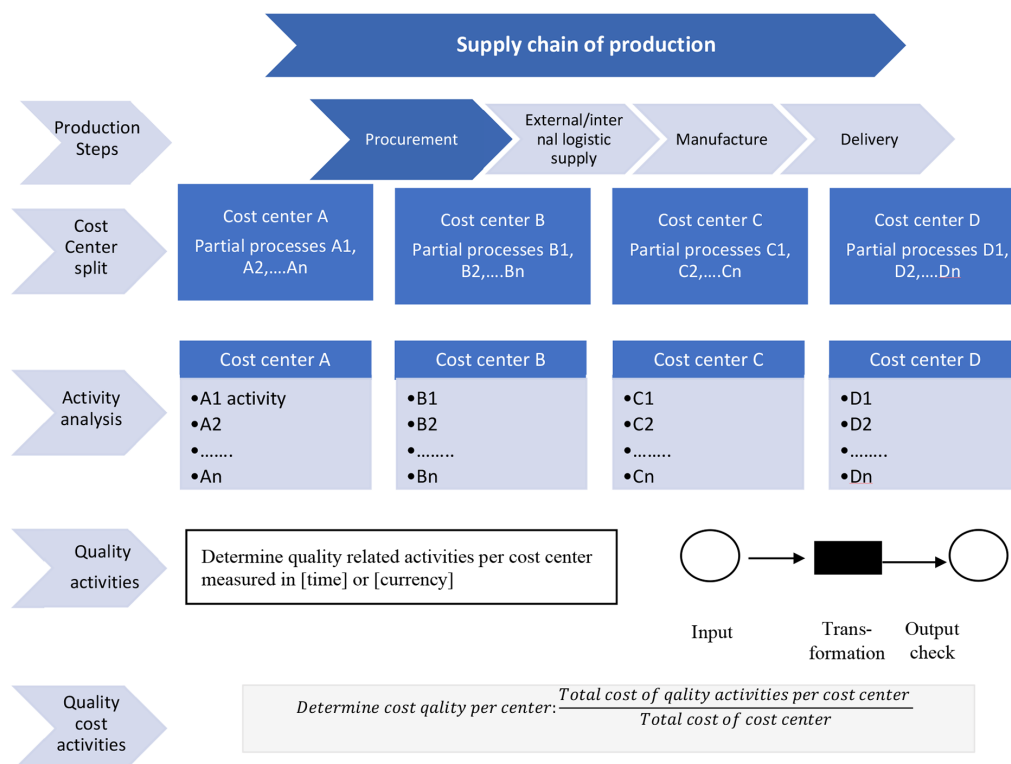


Figure 6. Method to analyze and evaluate the cost of quality in production

Source: Ocakci et al., 2021

5. OBSTACLES AND DIFFICULTIES IN ESTIMATING QUALITY COSTS

There are many obstacles and difficulties that businesses encounter when estimating CoQ and have been recorded by the researchers. Some of them are the following: lack of understanding of the concept of CoQ, lack of knowledge of how to monitor CoQ, lack of management interest in monitoring CoQ, difficulty in collecting quality data, financial difficulties in meeting the required costs for measuring CoQ, lack of adequate accounting and computer systems necessary to monitor CoQ, lack of collaboration with other departments, management philosophy and corporate culture that does not promote CoQ evaluation, the belief of management that there is no value in any effort to fully measure CoQ, lack of experienced human resources to complete the project, management considers CoQ to be an additional workload, organizations do not see the benefits of CoQ and organizations focus on areas that are considered more important (Psomas et al., 2018).

According to Milicevic (2000), who analyzed the methods of measuring and working with quality costs in some 30 enterprises in Sweden, he recorded the problems they encountered (Table 3) (Milicevic, 2000).

Table 3. Problems in measuring quality costs

Problems type	Description
Area of Measurement	Many organizations measure quality cost referring to production including, for instance, waste, reworks, control and examination. Costs generated in other parts of business system were measured at a very limited extent or were not measured at all. These costs are considered to be difficult to measure.
Causes for Measurement	In some organizations adequate methods of measurement have not been developed and accepted. They believe their basic objective is to provide neat reports and not to use the information from the reports to promote the status. There is no real connection with promotion activities. In these cases, quality cost measurement can become the objective in its own right without any practical application.
Responsibility	The question that should be “blamed” for various costs or how to define who really caused the cost generation are yet another difficulty in measurement. Since many organizations build systems in which the staff reports on problems and errors, it frequently happens that the staff finds very unpleasant to report on quality cost generated at their position, and very frequently they fear to do that which results in hiding of certain costs, unpleasant for the staff.
Management	Purpose of reporting on quality cost is for management to be able to define the priority of prevention activities. One of the reasons this does not function properly is lack of interest and responsibility on the part of leadership for the obtained information, which reduces motivation of the staff for future reporting on problems and errors.
Staff	In many companies the staff considers reporting on quality cost as additional work and they do not understand either the meaning of good and reliable measurements or their purpose.
Accuracy	The management frequently thinks that the results of measurement of quality cost contain unreliable information, therefore they find the results weak bases for decision making and they do not use them. Successful companies most frequently initiate their measurements by small scope, i.e. they include only the costs with the highest amount, and then they gradually develop and build reliable system of measurement and perceiving of all costs.
Application	It is interesting that various experiences show that it is the best practice to apply quality cost measurement system from the very beginning. The companies that tried to initiate measurement several times face serious problems when refreshing these activities and being offered new methods due to the negative response of the staff.
Comparability	Production oriented companies find their quality costs higher than in service-oriented companies. This is caused by the fact that measurement of production costs is far easier and more widely accepted. Of course, the highest quality costs are registered in companies that developed the best methods of measurement. Therefore, quality costs in different companies cannot be compared, unless it is certain that the same methods were used in data gathering.

Source: Milicevic (2000)

6. BENEFITS OF MEASURING QUALITY COSTS

In the international literature, it is generally accepted that the estimation of quality costs offers several benefits. In addition to the ability it offers to managers and engineers to speak the same language (Makhanya et al., 2018), the main ones are the following: increase in profit, increase sales volume, improve the quality of products/services, increase the competitiveness of the company, achieve significant cost reductions, improve productivity, increase customer and employee satisfaction, reduce customer and employee complaints, reduce customer complaints, eliminating all forms of waste, providing vital information so that management knows the magnitude of the problem, identifying high-cost problem areas, prioritizing improvement actions with the greatest possible efficiency, assessing the value of individual quality activities, increasing the overall level of quality awareness and explaining conflicting cost behaviors that have historically been disastrous for professionals and researchers (Psomas et al., 2018, 2021).

Many elements vary depending on the application and successful implementation of quality costs. If an enterprise can implement CoQ, then the market share, reputation, profits, etc., will increase. On the other hand, defective products, customer complaints, etc., will be reduced with the successful implementation of CoQ. Various factors that increase and decrease are listed in Figure 7 (Kumar et al., 2020).

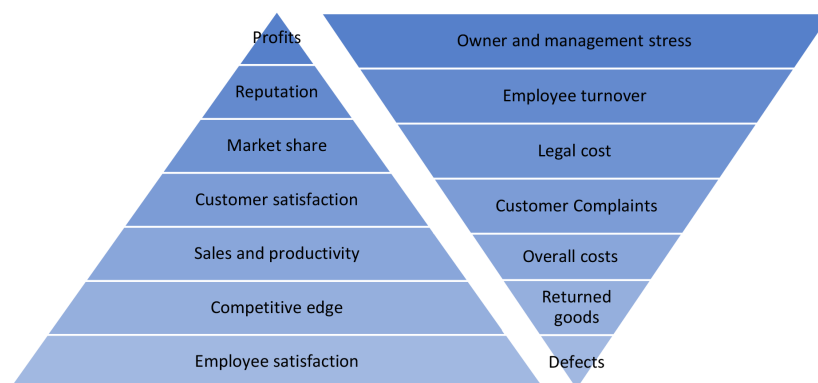


Figure 7. Increasing and decreasing factors in implementing CoQ

Source: Kumar et al., 2020

7. DIMENSIONS OF QUALITY COSTS

Quality costs undoubtedly affect: the quantity of production, investment decisions, the allocation of monetary resources, money costs, the performance of the enterprise, cost and quality control, the success of a project, quality performance, economic policies and budget, overall quality, quality management strategies, present a reliable analysis of a new product, the value chain, customer satisfaction, financial results, business image, overall quality management strategies, quality-related learning, and quality improvement programs (Psomas et al., 2021).

Many researchers have tried to understand the correlation between different dimensions of quality costs. In the literature, general assumptions are found according to which: a) there is a relationship between prevention and estimation costs as well as between internal failure costs and external failure costs, b) there is an inverse relationship between prevention costs plus estimation costs and failure costs: in other words, there is a strong negative relationship between compliance costs (prevention and estimation costs) and non-compliance costs (internal and external

failure costs), c) the increase in prevention and evaluation costs will reduce the total CoQ, d) the cost of prevention has the greater impact on the total CoQ than on the cost of evaluation, e) there is a strong negative relationship between the cost of prevention and the cost of internal failure and between the costs of prevention and the external costs of failure and d) there is a strong negative relationship between the cost of assessment and the cost of internal failure and between the cost of estimating and external failure costs (Psomas et al., 2018).

8. CALCULATING THE COQ IN A FRUIT CANNING COMPANY

In this section, we present the calculation of the cost of quality, CoQ, in a fruit canning company. The company offers a wide bundle of products: essential oils, dried orange peel, supports for sorbets, organic products, fruit cells, canned food, cubes & fruit slices, mixtures and juice bases, coffee syrups, fruit preparation, and juices. Quality assurance in the value chain starts at the influx of fruit on plants and continues at all stages of production, and storage of inventories, and ends with the delivery of final products to customers. Quality control laboratories play an important role in quality assurance, manned with properly educated staff and appropriate tools to conduct comprehensive chemical and microbiological tests in specially equipped rooms with the use of the latest technology. Process control ensures consistent product quality in line with standards and specifications. The company's Food Safety Management System (FSMS) meets the requirements of the standard ISO 22000: 2005.

Food production is performed under strictly controlled conditions, from the receipt of raw and auxiliary materials to the final shipment of the product. Inventories are monitored in real-time in instances of the production process flowchart with a special focus on critical control points related to inventories. Preventive and corrective actions are also determined to ensure that the final product complies with the requirements of the ISO 22000 standard. The process diagram in Figure 8 presents the production flowchart with all necessary Critical Control Points (CCPs) and Operator Control Points (OPRPs).

The process is controlled by six operators in one eight hours shift. The quality-related tasks are distinguished via the Critical Control Points (CCPs) and Operator Control Points (OPRPs). Each operator is attributing effort to different quality activities depending on the role he/she plays in the process and the duties he/she has been assigned.

Event log data were analyzed and effort-based cost calculations were made, as shown in Table 4. For a complete explanation of the approach, the interested reader should refer to the previously published research (Bougoulia & Glykas 2022; Glykas & Johnichen 2017; Glykas et. al., 2015; Glykas, 2011; Ampantzi et. al., 2013; Glykas, Holden et. al., 1993; Glykas, Wilhelmij et. al.1993).

In Table 4, the left column depicts the quality management activities performed by the six operators in the production department. For each operator, we calculate the percentage of effort devoted per activity based on the event log data. We then calculate, per operator, the total percentage of effort devoted to quality management-related activities. For example, for operator 1 the total percentage of effort devoted to quality activities adds up to 49% and for operator 6 to 57%.

The total yearly employee expense is provided by human resources or the accounting department. For operator one the total expense is 13 254 euros whereas for operator six 12 498 euros. The multiplication of the percentage of effort per operator activity by the total employee expense results in the calculation of the cost of each operator's activity.



Figure 8. Production Flowchart of a Food Canning Company

By adding all operator costs per activity we can calculate the total activity costs for all six operators. The total cost per activity is presented in the last right column. In the same way, we calculate the total effort per operator and divide it by the total effort of one employee (100%) and we calculate the Full Time Equivalents (FTEs) per activity. For example, the FTEs for the activity “Peeling with caustic soda solution” is 1.20.

This outcome means that the organization could assign one full time employee to work exclusively on this activity and eliminate the percentages of effort that all others operators devote to the activity. The freed percentages of effort per activity for each operator can be assigned to his/her remaining activities and thus reorganization be achieved.

In the last two rows below the main table we present the total number of cans produced per year by the company (12 432). If we divide the total cost of quality conformance by the total number of produced cans, we can attribute quality conformance costs per can have produced. In the real life case study, quality conformance costs are calculated to 3.2335 euros.

Table 4. Effort Based CoQ Calculations

	Operator 1		Operator 2		Operator 3		Operator 4		Operator 5		Operator 6			
Cost of Quality Related Tasks	%	Cost	%	Cost	%	Cost	%	Cost	%	Cost	%	Cost	FTE	Activity Cost
Fruit Supply (ORP1,2 C)	4	530.16	4	440	0	0	0	0	0	0	0	0	0.08	970.16
Packaging Material Intake (OPR 3)	5	662.7	3	330	0	0	0	0	0	0	0	0	0.08	992.70
Inspection Pits for Residues (OPR P4 Ph)	4	530.16	2	220	3	420	0	0	0	0	0	0	0.09	1170.16
Collection and pitting (OPR P4Ph)	2	265.08	2	220	2	280	5	716.4	3	346.29	3	374.94	0.17	2202.71
Peeling with Caustic Soda Solution (CCP1C)	18	2385.7	22	2420	18	2520	22	3152.2	22	2539.5	18	2249.6	1.20	15266.98
Visual Inspection sorting/cleaning peeled peaches (OPR P4Ph)	16	2120.6	12	1320	17	2380	22	3152.2	17	1962.3	22	2749.6	1.06	13684.67
Vessel Filling (CCP2 Ph)	0	0	0	0	3	420	4	573.12	3	346.29	3	374.94	0.13	1714.35
Venting for Sizes A9, A10, A12 (CCP3M)	0	0	0	0	2	280	4	573.12	0	0	2	249.96	0.08	1103.08
Sewing Boxes (CCP4M)	0	0	0	0	5	700	3	429.84	0	0	3	374.94	0.11	1504.78
Pasteurizationand Cooling (CCP5M)	0	0	0	0	4	560	0	0	0	0	3	374.94	0.07	934.94
Pasteurizationand Cooling Cooling Water (CCP6M)	0	0	0	0	2	280	0	0	0	0	3	374.94	0.05	654.94
TOTALS	49	13254	45	11000	56	14000	60	14328	45	11543	57	12498	3.12	40199.47
							Number of Cans proeduced per month:		12432					
							Cost of quality conformance		3.2335					

9. CONCLUSION

Although the concept of quality was introduced in the 50s, in the international literature however, few studies have been carried out to measure the cost of quality. There are still questions to this day as to how all the components of CoQ dimensions are calculated, i.e. there is still limited research on human resources CoQ calculation. This is mainly due to the misconception that the achievement of better quality entails increased costs was a deterrent for businesses to switch to investments in the use of advanced quality costing schemes.

As it becomes clear from the literature review, the best quality improvement policy finds the right balance between the lowest possible CoQ and the maximum achievement of quality compliance. The ultimate goal is the achievement of quality conformance in the most cost-effective way.

It is widely accepted that CoQ estimation offers several benefits, including an increase in profit, an increase in sales volume, an improvement in the quality of products /services, an increase in the competitiveness of the company, the achievement of significant cost reductions, the motivation of employees and the improvement of their productivity.

In this paper, we presented our research outcome which is based on effort-based costing and enables managers and accountants to calculate human resources costing. The proposed model is extracting and calculates percentages of effort per activity from event logs used for process mining. The usefulness and applicability of the method were proved via its application to a fruit can production company for the calculation of total quality conformance costs. These costs were attributed to each can produced and thus provides a direct quality conformance cost as a percentage of the total cost per can.

Our future research will concentrate on the enhancement of the proposed CoQ model as well as the development of a software application and system that can extract records from event logs and calculates effort-based data to be used for CoQ calculations.

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Employees' Perception of Climate Change and Its Impact on Business Competitiveness

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Abstract: *Climate change in the form of extreme weather events is becoming more frequent and severe, and populations across Europe are more affected by droughts and floods. All this affects workers' perceptions of climate change and how they assess its impact on the competitiveness of the companies they work for. A survey of Slovenian workers (N = 212) examined the associations between reported concerns about climate changes concern and perceptions of its impact on business competitiveness. In regression analyses, exposure was associated with greater concern about climate change and negative perceptions of business competitiveness. Our study suggests that workers' awareness of climate-related exposures in their local environment, along with personal exposures, is associated with increased concern about climate change and its negative impact on business competitiveness. As sustainable competitiveness needs well-informed workers, our findings suggest that policies aimed at raising awareness of climate concerns and their impact on business awareness should take into account workers' perceptions.*

1. INTRODUCTION

The world is warming very quickly, driven by the upward trend in greenhouse gas emissions. The global rise in temperature means that extreme weather events are more frequent and more severe, and populations across Europe are more affected by droughts and floods. According to the European Drought Observatory, around 60% of the EU and the UK were affected by drought in the summer of 2022. Record heatwaves due to climate change have dried up rivers across the continent and reduced water reserves to historic lows (Toreti et al., 2022). This affects both workers' perceptions and the functioning of businesses. There is an urgent call to reduce the negative impact of traditional corporate practices on planet Earth.

Competitiveness remains the most important strategy for companies to survive. Several people have linked sustainability to higher expenses, which can occasionally hurt competitiveness. It is crucial to consider how these behaviors and the dynamics of this link between sustainability and competitiveness affect the desired transition to sustainability as this might occasionally lead to pushback from stakeholders and institutions. Modern trends confirm the need to take environmental factors into account in the effectiveness of companies. Because people sometimes link sustainability with negative effects, many businesses have not yet adopted practices to achieve sustainability, which is vital for their competitiveness. They must therefore strike a balance. Some companies seem to see sustainability as an improvement in competitiveness. Others, however, believe that it is unnecessary and costly to implement. It turns out that they may have different perceptions of the benefits and features of sustainability that can help them remain competitive. Most of the current practices in companies are not sustainable, sometimes due to ignorance or isolated actions (Lopez-Torres et al., 2021).

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The tendency of many businesses to support environmentally friendly strategies, implement sustainable development objectives that will help solve local and global environmental problems, lessen anthropogenic pressure on the environment, conserve resources, and shape competitive development of the nation and the business sector as a whole describes the development of the business sector today. The consumption of green goods and services is on the rise, and multiple distribution channels are being used to promote green products, according to current development trends (Chygryn et al., 2021).

The contradiction between environmental preservation and economic competitiveness, according to Potter (1991), is a false dichotomy based on a limited understanding of the sources of wealth and a fixed understanding of competition. In fact, high rules can increase competition across the board in the economy. At first look, rigorous regulations appear to increase expenses and reduce the competitiveness of businesses. This might be the case if nothing changes other than the addition of pricey pollution control machinery. Cleaner production is described as the ongoing application of an integrated preventive environmental strategy to processes, products, and services in order to improve overall efficiency and lower hazards to persons and the environment by the United Nations Environment Programme (2022).

Despite relatively extensive research on the subject of competitiveness, little is known about the connection between sustainability and competitiveness. Systemic literature review shows that sustainability for businesses is neglected, sometimes due to ignorance, and lack of maturity in sustainability, associating sustainability only with more costs and not with competitiveness (Lopez-Torres et al., 2021).

For climate change mitigation and adaptation programs to be effective, it is essential to comprehend how employees view climate change and its effects on competitiveness. There is little data on the relationship between exposure and employees' perceptions of competitiveness, despite the fact that studies of populations exposed to extreme weather events and air pollution have highlighted the importance of direct experience in perceptions of climate change and its health impacts. To determine whether reported exposures were connected to public concerns and perceptions, a representative UK adult poll was conducted. They looked into the relationship between concerns about climate change and beliefs about how it might affect people's health and their awareness of climate change-related exposures. According to the multivariate analysis, increasing climate change worries were linked to reported exposure to flooding and air pollution (Graham et al., 2022).

We investigate whether reported exposure to droughts, floods, and air pollution is linked to increased concern about climate change and unfavorable perceptions of its effects on business competitiveness in order to close this gap.

2. METHODS

In order to investigate how employees' percept climate change and business competitiveness, Slovenian employees were invited to take part in the survey. The data was gathered between 15 July and 20 August 2022. The information was gathered through a snowball-style online survey that took, on average, around 10 minutes to complete. A total of 212 employees working in different companies in Slovenia took part in the study.

Concern about climate change was measured by the question "How concerned are you about climate change, if at all?" with a response option of 4 (not at all concerned, not very concerned, fairly concerned, very concerned). "Do you think climate change will be beneficial or bad overall for the competitiveness of firms in Slovenia?" was the survey question used to gauge perceptions of competitiveness, with five alternatives for the response (entirely good, more good than bad, equally good and bad, more bad than good and entirely bad). Participants were questioned about their exposure to "droughts," "floods," and "air pollution (bad air quality)" over the previous 12 months at the end of the survey. Separate questions were given to each participant asking if they were aware of these exposures "in your local region," if they had directly encountered them, or if they had heard about them from friends and relatives.

Bivariate analyses examined associations between reported exposure and concern about climate change, and between reported exposure and perceptions of impacts. Two regression models used multinomial regression to assess associations between exposure and climate change concerns and perceptions of impacts on business competitiveness, using SPSS version 26. In each case, the reference groups were those who are not concerned about climate change (combining those who are not concerned at all and those who are not very concerned) and those who do not perceive the impact on business competitiveness to be bad (a combination of those who perceive the impact as completely good, more good than bad and equally good and bad). The models were built hierarchically. The threshold for inclusion in the for retention was 0.1 at $p < 0.005$ and was regressed stepwise. The models were tested, with the goodness of fit, r^2 estimates and log-likelihood reported for each model along with the percentage of correct prediction.

3. RESULTS

The majority of respondents were concerned about climate change (fairly: 47%; very: 36%) and perceived its impact on business competitiveness as negative (more bad than good: 46%; entirely bad: 25%). With respect to exposures, 66% of respondents cited drought, 36% flooding and 33% air pollution.

Table 1. Climate change concern and perceptions of its impact on business competitiveness by reported exposure to drought, floods and air pollution (N = 212)

		Total		None	Yes	Chi ² Test
		Count	Column			Sig
Climate change concern	Not concerned	36	17%	66%	14%	< 0.001
	Fairly concerned	100	47%	43%	28%	
	Very concerned	76	36%	31%	37%	
Impact of climate change on business competitiveness	Entirely good, more good than bad, equally good and bad	61	29%	49%	25%	< 0.001
	More bad than good	97	46%	41%	28%	
	Entirely bad	53	25%	29%	40.1%	

Source: Own research

As Table 1 shows, reported exposure to drought, flooding and air pollution was associated with both concerns about climate change and perceptions of its impact on business competitiveness ($p < 0.001$). Among those who are not concerned about climate change, 66% reported not being exposed to drought, air pollution and/or flooding. Among those who were fairly and very concerned about climate change, the proportions were 43% and 31% respectively. A similar relationship is seen in the perception of the impact on business competitiveness ($p < 0.001$). Nearly

half (49%) of those who did not consider the impact on health to be bad (as entirely good, more good than bad, equally good and bad), compared to 41% and 29% in the "more bad than good" and "entirely bad" groups, respectively, said they had not been exposed to drought, flooding, or air pollution.

As seen in Table 2, exposure was significantly linked to larger concerns about climate change, with exposure at the local, individual, or combined levels always having a favorable correlation with concern. The likelihood of being fairly concerned about climate change quadrupled when local or personal exposures (among one's self, family, and friends) were reported (local: 2.00; personal: 2.42). Reporting both local and personal exposure increased the odds to 3.12.

The model had a strong fit, correctly predicting 53% of all cases, passing the goodness of fit test with a significant (> 0.05) result, and accounting for 20% of the variance in the degree of climate worry, according to r^2 .

Table 2. Multinomial logistic regression model of reported exposure to drought, floods and air pollution against climate concern (N = 212)

Climate Change Concern (Reference Category: Not at All/Not Very Concerned)		Sig.	Adjusted Or *	95% CI	
Fairly concerned					
Exposure Reference (no exposure)	Local exposure	0.001	2.001	1.111	3.214
	Personal exposure	0.001	2.419	1.198	5.971
	Both local and personal	0.001	2.935	1.761	5.631
Very concerned					
Exposure Reference (no exposure)	Local exposure	0.001	3.112	2.109	4.991
	Personal exposure	0.001	3.931	1.761	9.876
	Both local and personal	0.001	5.219	3.721	9.973

Source: Own research

The regression model calculated that exposure had a negative contribution to the likelihood of perceiving the effects of climate change on company competitiveness (more bad than good or entirely bad). All other comments were included in the reference category (entirely good, more good than bad, equally good and bad). Table 3 demonstrates that local exposure is a strong predictor of believing that there would be more negative than positive effects of climate change on business (OR 1.97).

Table 3. Multinomial logistic regression model of reported exposure to drought, floods and air pollution against perceived impact of climate change on business competitiveness (N = 212)

Perceptions of impact of climate change on business competitiveness		Sig.	Adjusted Or *	95% CI	
Climate change is more bad than good for business competitiveness					
Exposure Reference (no exposure)	Local exposure	0.001	1.971	1.221	2.414
	Personal exposure	0.061	0.517	1.328	1.171
	Both local and personal	0.141	1.135	1.881	1.871
Climate change is entirely bad than good for business competitiveness					
Exposure Reference (no exposure)	Local exposure	0.001	1.912	1.419	3.791
	Personal exposure	0.001	1.831	1.161	3.176
	Both local and personal	0.001	2.419	1.721	3.173

Source: Own research

Exposure was more strongly associated with perceiving impacts of climate change on business competitiveness as entirely bad. Those who had local exposure were 88% more likely to believe the environment is completely detrimental to company competitiveness than those who had no exposure (OR 1.91). For those reporting personal exposure, the odds were higher (OR 1.83) and were further elevated for participants reporting both local and personal exposure (OR 2.42).

The model fit the data well, with 49.3% of the projected outcomes being accurate, the goodness of fit test being significant (>0.05), and the r^2 showing that 9.8% of the variance in respondents' perceptions of how climate change will affect company competitiveness was taken into account.

4. FUTURE RESEARCH DIRECTIONS

Due to shareholder pressure and fierce competition in international markets, many companies focus on short-term profits. A focus on the short term is frequently incompatible with the patience and risks required for sustainability. As a result, economic outcomes and sustainable development frequently clash. Yet, by using sustainability innovations, businesses can meet the growing competition in shifting marketplaces while also advancing sustainability. The systematic literature review shows that sustainability innovations have a positive impact on the competitiveness of companies. The outcomes of sustainability innovations can be divided into increased value creation, reduced costs and non-financial assets. The conflict between sustainability and economic outcomes can thus be mitigated by sustainability innovations, as they contribute to both sustainability change and competitive advantage (Hermundsdottir & Aspelund, 2021). Understanding how employees perceive climate change and its impact on competitiveness is crucial for introducing sustainable innovations.

The study has some limitations that could reduce future studies. First, the study is not representative and the conclusions cannot be generalised as the potential participants were recruited through the snowball method. As this was an online survey, the views and concerns of some of the most vulnerable workers in Slovenia are likely to be underrepresented. Therefore, future studies should also include these workers in different sectors of the economy. Also, there is a need for more diversified research approaches in experimental and design research as well as sustainability for company competitiveness.

It is well recognized that factors such as media coverage of climate change have an impact on how people perceive the phenomenon of climate change. Media attention to climate change is episodic and peaks when research and policy are concentrated on it. This is true for both traditional media and social media. Our survey was conducted in a month (July and August 2022) when mainstream media and social media coverage of climate change and drought was high. It is important to repeat the survey in times of lower media coverage.

5. CONCLUSION

Whether reported exposures were connected to public concerns and perceptions were investigated in the online poll of Slovenian workers. We explored whether employees' perceptions of the effects of climate change on business competitiveness and their awareness of these consequences in their immediate surroundings were connected to their climate change worries. In the multivariate analyses, after controlling for other factors, reported exposure to drought, flooding and air pollution was associated with increased concern about climate change and more negative perceptions of its impact on business competitiveness.

As sustainable or green competitiveness needs well-informed workers, our findings suggest that policies aimed at raising awareness of climate concerns and their impact on business awareness should take into account workers' perceptions.

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The Influence of the Pandemic COVID-19 on the Leadership Styles of Management

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Abstract: *The goal of the research conducted in the paper is to indicate changes in leadership styles that occurred as a result of the Covid-19 pandemic. The author, through the analysis of various sources of literature, emphasized the changes in the leadership styles of managers that occurred as a result of the pandemic. The work contains a description of the behavior of leaders who successfully adapted to the changes that took place during the crisis. Special attention in the paper is devoted to the importance of shifting the focus of leaders from achieving the company's business goals to a much broader perspective, which also includes helping employees to more easily face the uncertainty and risks they were exposed to during the Covid-19 pandemic. The paper aims to point out the practices of successful leaders, which are largely applicable in conditions after the end of the pandemic*

1. INTRODUCTION

The Covid-19 pandemic represents the most complex situation that modern society has faced since the end of World War II. It represents the largest global pandemic after the Spanish flu, which occurred at the beginning of the 20th century (Ahern & Loh, 2020). The pandemic, which lasted more than a year at the global level, resulted in changes in all segments of society. Companies had to adapt all segments of their business to the new market conditions, which required them to implement very significant and comprehensive changes. Managers had to adapt their leadership styles and ways of behaving to the new conditions, which required paying much more attention to employees and providing assistance in dealing more effectively with the pandemic and its consequences. The Covid-19 pandemic was an event that represented a global surprise in many ways, for which no country had prepared response plans. Society has experienced drastic changes in all segments of its functioning, even in the simplest forms, such as the introduction of social distancing, movement bans, the obligation to wear masks, etc. (Francisco et al., 2020)

2. DILEMMA THAT LEADERS FACED DURING THE PANDEMIC OF COVID-19

The Covid-19 pandemic presented an extremely big challenge for leaders in all parts of the world, regardless of the size and activity of companies and their position in organizational structures. The complexity of the challenges facing leaders was compounded by the high levels of uncertainty associated with the pandemic. The pandemic represented a test of all business segments and the ability of managers to adequately adapt their behavior to the new situation. As a common feature of major health crises, such as the Covid-19 pandemic, the fact that they put leaders in front of challenges that are significantly different from the challenges they face in all other crises stands out (Baker, 2020).

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During the pandemic, leaders faced a large number of dilemmas and conflicting demands. An additional problem was the fact that there were no simple answers to most of these dilemmas, which significantly complicated the work of leaders and made decision-making difficult (Harris & Jones, 2020). Taking into account all, often conflicting perspectives, is of key importance in adapting the leadership behaviors of managers to new conditions. During the pandemic, managers were faced with numerous requirements that did not exist until then, which resulted in a large number of dilemmas they faced (Baker, 2020).

The basic and most significant dilemma faced by managers during the Covid-19 pandemic was reflected in the definition of leadership activities that they will emphasize during their work. In addition to achieving the best possible results in conditions characterized by numerous changes in the market and high levels of uncertainty, managers had to pay much more attention to employees and their fears that were a consequence of the pandemic.

3. CHANGES IN THE BEHAVIOR OF LEADERS CAUSED BY THE PANDEMIC COVID-19

Good leaders can effectively and appropriately assign meaning to situations characterized by high levels of complexity and uncertainty (Gurr & Drysdale, 2020). Expressed uncertainty, which is one of the basic characteristics of the Covid-19 pandemic, presented numerous challenges to managers, which they had to face in the best possible way. Uncertainty required significant changes in all segments of the decision-making process and the creation of very quick responses to the changes that were occurring, which are not characteristic of management in traditional business conditions (Ahern & Loh, 2020). As the basic and most significant challenge faced by the leaders during the pandemic, the need for major changes in the behavior towards the employees stood out, without which it was not possible to ensure the effective management of the new situation.

One of the main tasks that the Covid-19 pandemic placed before the leaders were reflected in emphasizing the care of employees (Wilson, 2020). The development of the pandemic and the consequences it led to indicated significant changes in the behavior of a large number of managers, who began to devote more and more attention to recognizing the needs of employees and showing empathy towards them and willingness to help them. Managers' leadership styles had to be adapted to radical changes in employees' priorities and emphasis on personal and family members' health.

The drastic increase in the number of employees who work from home and the transition of schools to an online teaching system required an emphasis on establishing the best possible balance between the private and business obligations of employees. A factor that greatly influenced the behavior of employees during this period was their exposure to the uncertainty associated with a situation that could threaten their lives and health. Successful leaders indicated to employees that the companies and they personally are aware of the changes in their priorities and that they fully understand them.

A large number of managers at the highest levels already at the beginning of the pandemic addressed employees with messages that aimed to show the company's concern for them and their families. Companies and their managers have changed their behavior and attitude towards employees to a very large extent. Leaders increasingly focused their activities on the emotional, mental

and physical well-being of employees. Numerous companies have also created various support programs, which have enabled their managers to significantly improve their leadership styles.

The analysis of the activities carried out during the Covid-19 pandemic indicated one common characteristic of the behavior of all successful companies and the leaders who work in them. All successful leaders emphasized employees in their work, while business activities were put on the back burner. Initial changes in managers' leadership behaviors were reflected in ensuring the safety of employees (Briscoe & Nyereyemhuka, 2022). In addition to employees, these activities in a large number of companies were also aimed at customers, to support them in times of crisis, which after the end of the pandemic in many cases increased their loyalty to the company.

The changes that successful leaders implemented during the Covid-19 pandemic were largely based on changes in the wants and needs of employees and customers. The perceptions of all people during the pandemic have changed to a very significant extent compared to the period before the pandemic. These changes resulted in extremely large changes in factors that affect employee motivation. Leadership styles had to be adapted to these changes, to ensure that the activities carried out by managers have a positive effect on employees and their motivation. For all employees, regardless of their position in the organizational hierarchy and salary, during the crisis, the emphasis was placed on satisfying the basic needs from Maslow's hierarchy, above all those directed towards safety, security and health.

A large number of changes in leadership behaviors that occurred during the Covid-19 pandemic remained present in the work of managers even after the end of the pandemic. The leadership styles of managers must still be directed towards using the principles of empathy and concern for the well-being of employees. The emphasis on leadership behavior changes after the end of the pandemic must be placed on physical, psychological and financial elements.

The segment of leadership that is directed toward the physical well-being of employees includes behaviors that emphasize the cleanliness of the work environment, safety and health of employees (Ahern & Loh, 2020). Leadership activities aimed at psychological elements include various forms of improvement of working conditions, such as the introduction of flexible working hours, the possibility of working from home, etc. Even though it was introduced as an imposed solution to the problems caused by the Covid-19 pandemic, working from home has become an element that, even after its end, has a significant positive impact on employee motivation. Working from home has a significant positive effect on the well-being of employees' families, as it enables them to take care of children and elderly family members.

4. THE IMPORTANCE OF GAINING THE TRUST OF THE EMPLOYEES

Trust is an individual's expectation or belief, often in cases of vulnerability, that the motives or actions of another person are sincere, honest, and based on integrity and respect for ethical principles (Hutchinson, 2018). It can exist at the level of a system, an organization or an individual. Trust is a key element of leadership in modern business organizations. Establishing trust between managers and employees is one of the prerequisites for successful leadership (Bligh, 2017).

Situations in which employees are exposed to high levels of stress, such as the Covid-19 pandemic, further increase the importance of employees' trust in leaders. During the pandemic, successful leaders emphasized activities that should create trust among employees, as well as

all other interest groups associated with the company. Trust represented one of the most important elements of leadership behaviors, which was directed toward assisting employees to face the negative impacts and consequences of the pandemic more efficiently.

In situations characterized by high levels of uncertainty, such as the Covid-19 pandemic, the task of managers is to continuously collect relevant data and information that they will use in their leadership activities. All leader activities must be based on information that comes from reliable sources and they must be aligned with credible expertise and advice from professionals. In this way, the trust of employees is ensured, who see in leaders not only managers but also people who are ready to help them in situations when they are worried about themselves and their closest people (Ahern & Loh, 2020).

5. CHARACTERISTICS OF LEADERS WHO WERE SUCCESSFUL DURING THE PANDEMIC

Leaders' responses to crises and all activities they carry out during them must be based on ethics and value-based principles. In this way, leaders create a common sense of purpose among employees, which has proven to be a very strong motivating factor in the conditions of the Covid-19 pandemic (Wilson, 2020). The personal and professional values of managers, which support their ethical behavior in crises, represent the framework of their decision-making process. Leaders need to create a feeling among all employees that the greatest possible efforts are being made to protect them from the negative consequences of the pandemic, whereby a special emphasis must be placed on those persons who are in direct contact with consumers (Imai, 2020).

As elements of leadership behavior that have proven to be particularly effective in this segment, the creation of guidelines for the protection of the health of employees and their families, the provision of a sufficient number of employees who will rotate on the riskiest jobs, and the effective management of workload and well-being of employees can be singled out. The best results during the pandemic were achieved by those leaders who openly and honestly communicated with employees about all the uncertainties that existed.

High levels of empathy play an especially important role in situations where employees are exposed to risks and fears. Successful leaders expressed gratitude to employees for their efforts during the pandemic. It is very important that managers, in the stressful conditions that characterized the environment during the Covid-19 pandemic, show an interest in employees and their private lives, while providing help in situations when the need arises. In this way, higher levels of loyalty are created among employees, since they no longer see the company exclusively as a place where they work, but also as an organization that can help them in situations when the need arises.

Successful leaders took every opportunity to personally thank individuals and groups for the efforts they made while doing their jobs. Leaders are often ready to forgive employees for bad results if they have made efforts to do the job properly (Artigiani, 2005). The authentic leadership style that was developed in a large number of companies during the pandemic was based on honesty, showing concern and benevolence towards employees and their family members.

The pandemic and the states' responses to it, such as movement restrictions, have led to a feeling of uncertainty and anxiety in a large number of people, which in the most severe forms could completely paralyze their ability to function. During the pandemic, successful leaders tried as

much as possible to create an environment in which employees would feel that they could gain support in any situation when the need arises. Leaders and employees co-created environments that helped companies face the pandemic more effectively and achieve better results.

In creating and maintaining relationships based on trust, during the Covid-19 virus pandemic, both leaders and employees played an equally important role. Leaders must have confidence in the employees they lead, especially in situations where employees have been given some responsibility or when they are actively involved in decision-making processes. The adjustment of the leader's attitude towards the employees and their alignment with the new conditions was one of the most important factors that influenced the success of the company's operations during the pandemic and in the period after it.

6. CONCLUSION

The Covid-19 pandemic has become one of the biggest global health crises in human history. It had previously unheard-of global negative effects in all segments of society's functioning, shutting down entire countries and leading to an exponential increase in the number of patients and deaths. The pandemic has placed managers who manage companies in extremely sensitive positions, which has made their work significantly more difficult. The application of leadership styles that were used before the pandemic proved to be insufficiently effective in a large number of cases, primarily due to changes in the behavior of employees and the numerous fears they were exposed to, which did not affect their behavior before it.

Uncertainty, an excessive amount of information that often came from unverified or unreliable sources and the extent of the crisis that arose can be singled out as the most important elements that influenced the behavior of employees. The best results during the crisis were achieved by managers who emphasize employees and found ways to calm them down and instill a sense of security in them. The leadership styles applied by successful managers created the impression among employees that the companies they work for are strong and reliable sources of support in crises that they and their families are going through. The Covid-19 pandemic and changes in leadership styles and ways of doing business in companies have greatly affected the awareness of the roles they play in modern society. In addition to the role of business entities, modern companies are also social organizations, whose goal is to ensure positive effects for the people employed in them, customers and society as a whole.

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Analysis of the Representation of Women in the Business Environment of the Slovak Republic

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Abstract: In Slovakia, the share of women in the total population of the Slovak Republic is slightly above 50%. Women entrepreneurs in Slovakia are still somewhat the exception rather than the rule. Their approach to entrepreneurship is not the same as that of men and women's entrepreneurial story is often linked to their personal lives. Women's entrepreneurship is a hot topic at the moment and by analysing it, it is possible to find out what are the characteristics, qualities, motives and factors influencing women's entrepreneurial activity in the Slovak Republic. The aim of our paper is to evaluate, through the analysis and development of statistical indicators, the position of women in the labour market in the Slovak Republic not only in terms of numbers but also in relation to the labour market (number of economically active women, employment, unemployment of women in the Slovak Republic) and also the degree of women's involvement in entrepreneurial activities in order to obtain a comprehensive view of the representation of women in the entrepreneurial environment in the Slovak Republic.

1. INTRODUCTION

Entrepreneurship is an essential part of the existence of any economy. It can be said that entrepreneurship is one of the factors that increase the productivity, capacity and size of an economy through creativity and competitiveness among others (Acs et al., 2008; Zanjirchi et al., 2019). The concept of entrepreneurship is not new in the current era. Many authors have demonstrated in their studies the strong relationship between entrepreneurship and the economic development of the economy. But we must not forget the essential dependence on entrepreneurship and social welfare and development (González-Sánchez, 2012). Given the importance of women entrepreneurship, we will address this issue in our paper. Without women entrepreneurs, economies would certainly not achieve the economic results they currently have. Women entrepreneurship is certainly now an important indicator of the overall development of individual economies. Women entrepreneurs play a significant role in job creation, wealth creation, poverty reduction, human development, education, etc. (Byrne et al., 2019). Women entrepreneurs are logically different from their male counterparts. Women entrepreneurs are more likely to share their entrepreneurial successes with their family or community in order to achieve economic and non-economic benefits, hence their importance in terms of sustainable economic development (Orses et al. 2006). There are many reasons why women entrepreneurs are in business. In general, it could be stated that in developed regions, women are mainly motivated to be entrepreneurs by self-fulfillment, desire for independence, desire for power, wealth, or social status (Shah & Saurabh, 2015). On the other hand, in backward regions, women are pushed into entrepreneurship due to social and economic situations such as high unemployment, low income, poverty, widowhood, etc. and in this case, entrepreneurship is a necessity for them to survive, to provide for the necessities of life. The paper aims to evaluate the position of women

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in the labor market and their level of involvement in entrepreneurship through the analysis of statistical data. We will look at women not only in terms of their numbers, but also in the context of the labour market, examining both the number of economically active women and female unemployment. We will interpret the status and development of statistical indicators related to women's position in the labour market. For the analysis, we have processed the available data for the period from 2010 to 2021. The data in this part of the analysis were obtained from the Statistical Office of the Slovak Republic and its Register of Organizations. Based on the assumption that the intensity of women's involvement in entrepreneurship is also related to women's economic activity and also based on the information that women may be driven to entrepreneurship also because they do not find sufficient employment and therefore start a business, we decided to find out whether there is a dependence between the number of women entrepreneurs and unemployment of women in the economy. To calculate the possible dependence, we used the Pearson correlation coefficient, which expresses the correlation between the two independent variables. The higher the value of the correlation coefficient, the more the considered values evolve together. We assume that there is a strong dependence between the number of women entrepreneurs and female unemployment.

2. WOMEN IN THE LABOUR MARKET AND BUSINESS

In the Slovak Republic during the analysed period, women predominated in the total population. Their percentage share in the total population is on average 52 %. However, we must state that during the last 12 years, the number of women in the population has decreased by 1% in favour of men. This is a negligible figure for the total population. If we analyse the population of the Slovak Republic in terms of the indicator of the economically active population, this ratio changes in favour of the male population. The share of women in the total number of economically active population ranges from 44.19% in 2011 to the highest value of 46.97% in 2021. In the period under review, the number of economically active population – women increased by 7%, which we can evaluate very positively, and which can also have a positive impact on the potential number of women who could engage in entrepreneurial activities in the near future, thus expanding the number of women entrepreneurs. We have to be very positive about the overall development of the female unemployment rate. Between 2010 and 2021, female unemployment fell by 7.6 percentage points.

Table 1. Statistical indicators – economically active women and female unemployment for the period 2010 to 2021

	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021
Population – women in thousands	2786,6	2767,3	2772,6	2774,9	2776,9	2779	2780,2	2783,7	2786,6	2789,3	2792,5	2762,8
Share of women in the total population in %	51,4	51,32	51,3	51,28	51,27	51,26	51,24	51,22	51,2	51,18	51,16	51,19
Economically active population – women in thousands	1209,2	1184,2	1199,2	1209,5	1211,8	1233,6	1247,4	1250,6	1240,4	1240,2	1231,3	1209,9
Share of women in the economically active population in %	44,68	44,19	44,31	44,54	44,52	45,05	45,23	45,4	45,17	45,24	45,39	46,97
Female unemployment rate in %	14,6	13,6	14,5	14,5	13,6	12,9	10,7	8,4	7,0	6,0	7,1	7,0
Women – self-employed in thousands	112,6	11,2	108,8	109,3	107,4	96,2	99,9	101,0	96,5	98,5	95,6	104,0
Share of women in the total number of self-employed persons in %	27,5	27,7	28,2	28,7	29,1	28,4	28,8	29,0	29,2	28,2	28,2	27,6

Source: processed based on data from the Statistical Office of the Slovak Republic and its Register of Organisations

Despite the fact that there are more women than men in the Slovak Republic, women entrepreneurs make up only less than a third of all self-employed persons in the Slovak Republic. There are, in fact, many factors (e.g. reconciliation of business and family) that make entrepreneurship a less attractive option for women than for men. Women represent about 52 % of the total population in Slovakia, but only 28 % of them are self-employed on average (Figure 1). Slovak women entrepreneurs are under-represented in the business environment from an EU perspective. The average of the EU countries in the period under review was as high as 32.3% of female entrepreneurs, while in Slovakia it is only 28% on average. We are therefore among the ten EU countries with the lowest number of women in business.

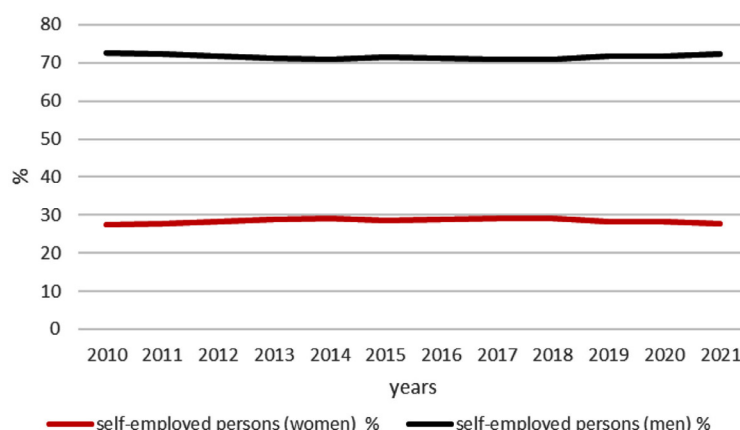


Figure 1. Percentage representation of women and men in self-employment in the Slovak Republic

Source: processed based on data from the Statistical Office of the Slovak Republic and its Register of Organisations

The ratio of men and women in business has been changing over time, in the past it was common for the number of women in business to be significantly lower than the number of men. Similarly, the number of women in senior management positions was certainly nowhere near the number of men in senior management positions. Over the last 50 years, the ongoing so-called feminisation of public life has led to a slight increase in the number of women in business and business leadership positions. The proportion of women in business also varies according to geographical and economic conditions. Although Slovakia is a relatively small country, we can observe slight regional differences in the number of women entrepreneurs. Thus, it follows that the conditions for women entrepreneurship in Slovakia differ. Within Slovakia, the largest share of women entrepreneurs is in the Prešov region, accounting for 14 % of all economically active women in the Slovak Republic, followed by the Bratislava and Košice regions. In all these three regions we can observe a high representation of women in the business sector. These regions are also characterised by a high unemployment rate of the population. From a psychological point of view, this situation may have motivated women who would otherwise have been employed in various sectors to start businesses in sectors that they had previously considered to be only leisure activities, e.g. jewellery making, clothing, various handicrafts, baking, and cooking. The borderline situation in their lives – unemployment, lack of means to meet their needs, or the needs of their family – gave them the courage and motivation to start their own business and create their jobs. Based on this information obtained by analysing statistical data and studying various literary sources, we decided to find out whether there is a relationship between the number of women entrepreneurs and the unemployment rate of women in the economy through regression analysis and Pearson's correlation coefficient. The analysis was based on the data presented in the table above. The resulting regression function has the

form $y = 89\,009 + 1331x$. The value of b_1 is positive, so we speak of a direct dependence and interpret it as follows: if the unemployment of women in the economy increases by one percentage point then the number of women entrepreneurs could increase by 1331. The value of the correlation coefficient is 0.741131461; the closer this value is to unity the stronger the dependence. In our case, we can conclude that there is a high degree of tightness in the relationship between the number of women entrepreneurs and female unemployment. R Square informs us that our chosen regression line explains about 55% of the variability in the number of women entrepreneurs, the rest is unexplained variability (the effect of random factors and other unspecified influences).

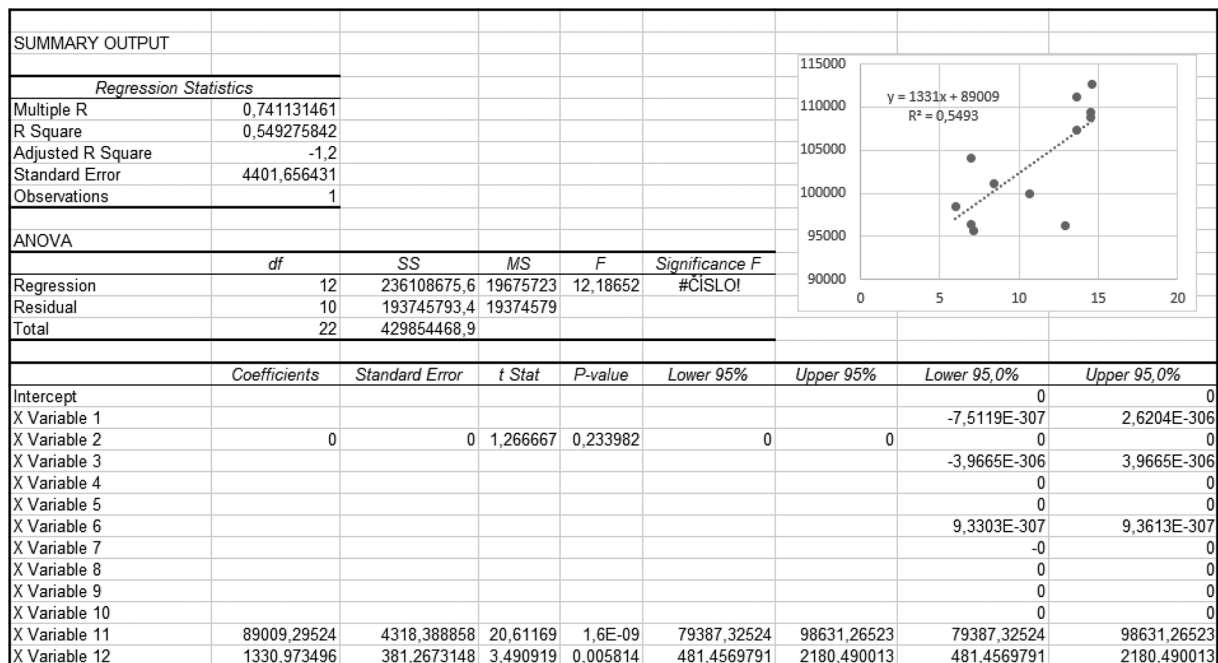


Figure 2. Regression and correlation analysis of the dependence between the number of female entrepreneurs and female unemployment in the Slovak Republic

Source: processed based on data from the Statistical Office of the Slovak Republic and its Register of Organisations

Problems in women's entrepreneurship most often stem from gender inequality and the perception of women as entrepreneurs in society as a whole. Certainly, one of the main obstacles that make it difficult for women to enter the sector is the need to reconcile family and business. It is this factor that discourages many women from entrepreneurship, for fear of public condemnation if they decide not to sacrifice their family life but their business life. Based on our analysis, there is a strong correlation between female unemployment and the number of women entrepreneurs, so we can say that women mostly resort to entrepreneurship even in times of existential problems, when they have to deal with providing for the basic needs of the family. And yet there is a markedly large difference between men's and women's entrepreneurship, and we see these differences precisely in the way they deal with the obstacles and barriers to entrepreneurial activity and in the way they approach entrepreneurship. It is also natural that values and priorities differ between the sexes and their entrepreneurial mindsets are derived from this. Women tend to be more cautious in business, trying to think through everything in detail and manage everything perfectly. Women often plan for the distant future, so they think about factors such as family, future housing, children, etc., when they start a business and direct their entrepreneurial intentions accordingly. Women tend to be very innovative at the start of a business, but as time goes on, this enthusiasm for adapting new innovations fades, which is a detriment. The difference between men and

women on a non-physical level can also be observed in the fact that men are predisposed to be active, thrill-seeking and strive for performance and order unlike women. Women's qualities include calmness, honesty, obedience, altruism, which means that women will be much better able to cope with constantly changing legislation, various administrative duties during business, and will be more flexible in responding to these changes. When entering the business world, a potential entrepreneur, whether male or female, may encounter a very wide range of obstacles and barriers that must be overcome. In the conditions of the Slovak Republic, these are still chronically known shortcomings, such as administrative and bureaucratic burdens, high tax and levy burdens, complicated, changing and unpredictable business legislation, problematic law enforcement, or clientelism and corruption (Pilková et al. 2019). We can say that despite a sufficiently high proportion of women in the population, we have a low proportion of women entrepreneurs, which is perhaps a consequence of the facts we have outlined in the previous text. As such, women have many positive qualities that can be used in entrepreneurial activities, but there are still some barriers in the economic, social or psychological spheres that limit women's entrepreneurial activities in the economy of the Slovak Republic.

3. FUTURE RESEARCH DIRECTIONS

Women are the most valuable and largest untapped resource of entrepreneurial potential in any economy. Empowering women in the economy will contribute to the creation of new jobs, and the creation of added value. The lack of women entrepreneurs is an untapped resource for the economy in terms of innovation, green business development, socially responsible entrepreneurship, etc. Women's entrepreneurship promotes their emancipation and empowers women in society, contributing to gender equality. Given these facts, it would certainly be interesting in the future to assess the contribution of women entrepreneurs to job creation, or their contribution to the creation of innovations, the extent to which they are involved in the process of socially responsible entrepreneurship, etc.

4. CONCLUSION

In conclusion, we can say that in the conditions of the Slovak Republic women entrepreneurs can be an important driver for future economic, social and sustainable development and competitiveness of the economy. Many studies have shown the positive impact of women entrepreneurs on the economy, but even so, gender inequality has a negative impact on women entrepreneurship. Women are less likely to become entrepreneurs due to their social status, family conditions, economic conditions, etc. The paper aimed to point out the existing potential in the labour market in the form of the female population, which is not sufficiently activated.

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Development Trends of Human Resources in Public Administration in Slovakia

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Abstract: *The paper identifies the critical factors in the development of public administration in Slovakia by 2030, considering human resources development, innovation, and digitization. The aim of the paper is to characterize the mission and functions of the public administration, the most significant trends in human resources development and measures necessary to facilitate innovations and upgrading in the public administration. The paper considers the valid legislation, data analysis and development trends in the public administration sector in Slovakia, including the quantity, quality and competitiveness of human resources potential and the digitization of public administration and the innovations in the labour market. The public administration sector performs the tasks entrusted by the state, framed, and defined by the public interest. The public administration sector has a cross-sectional character and shows intersections with other sectors.*

1. INTRODUCTION

In its essence, public administration represents the administration of public affairs, which is implemented as a manifestation of executive powers on behalf of the state. Public administration is carried out on behalf of the public interest and is carried out by subjects as an obligation imposed by legal norms. Public administration ensures the executive function (in relation to the legislative body of power) through governmental and non-governmental institutions.

From an organizational point of view, the system of public administration institutions in the Slovak Republic integrates the goals and functions of state administration and self-government. The central state authorities and the territorial state administration are mainly focused on the implementation of the interests and demands of the state. Self-government institutions, including territorial (regional and municipal) self-government and public corporations, have an autonomous status at all levels of the administrative division of the country.

The main goal of public administration entities is to fulfil the tasks of the state and provide services to citizens. The mission of the territorial self-government is the management of the entrusted territory, provision of services to citizens and investment and development activities of the territorial self-government. In cases stipulated by law, it also performs tasks of the state, which are delegated to territorial self-government as transferred performance of central state administration.

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Human resources in public administration represent human potential, which is made up of all elected representatives and employees in public administration. In addition to the quantitative characteristics of human potential, such as number and structure, human potential also includes qualitative aspects, such as education, culture, morality, interpersonal relations, and others.

2. PUBLIC ADMINISTRATION SECTOR IN SLOVAKIA

From the point of view of the sectoral distribution of the economy, the basic goal of the public administration sector is to fulfil the main tasks of the state, which are defined by the public interest, through individual parts. Compared to other sectors, the public administration sector is specific mainly because it has a cross-sectional character. This means that it comes to frequent intersections with other sectors, both in terms of the entities it includes and in terms of the tasks it provides. These are primarily the areas that fall under the public sector, especially education, healthcare, and social services. The basic value conditioning the operation of the entire public administration sector is the public interest.

Some sectors, including subjects of the private sphere, are partially connected with public administration. This mainly results from the fact that, in most cases, there is a system of public authorities that regulate the rules of operation of a specific sector (including the private sector) by legal authority. Public authorities, especially central state administration bodies, fulfil a regulatory and control function vis-à-vis the private sphere (e.g., energy, transport, computerization, etc.)

Employment of highly professional and qualified employees must be provided for public administration. To hire and retain employees, the public administration must be particularly competitive and improve the working conditions. Many approaches that are applicable in the management of human resources in the private sector can also be applied in public administration. However, the specificities of public administration, such as the scope, structure, and mission, representing a public policy and public interest, must be considered.

According to [Trexima Bratislava \(2022\)](#) in Slovakia, as many as 169,000 workers are employed in the public services and administration sector (according to SK NACE Rev.2 category "Public administration and defence; mandatory social security"). In terms of the number of employees, the most important employers in the public service sector are large "power" ministries. The largest employer in the sector is the Ministry of the Interior (police officers, firefighters, district office employees, etc.)

Table 1. The most important employers (TOP 10)
in the public administration sector by employer size category

Name of the employer	Size category
Ministry of the Interior SR	30 000 employees and more
Ministry of Defence SR	10 000 – 19 999 employees
Central Office of Labour, Social Affairs and Family SR	5 000 – 9 999 employees
Financial Administration SR	5 000 – 9 999 employees
Social Insurance	5 000 – 9 999 employees
Prison and Court Guard Service	3 000 – 4 999 employees
Ministry of Agriculture and Rural Development SR	3 000 – 4 999 employees
Public Health Insurance VŠZP, a.s.	2 000 – 2 999 employees
Ministry of Foreign and European Affairs SR	1 000 – 1 999 employees
City Administration of Bratislava, the capital of SR	500 – 999 employees

Source: Trexima Bratislava, In *Strategy of Human Resources Development in the Sector of Public Services and Administration by 2030. 2022.*

Concerning the age of the employees in public administration, the Human Resource Development Strategy in the Public Services and Law Sector highlights that the sector belongs among the sectors with older employees (47 years old on average), while the share of women is approximately 73%. According to the [Ministry of Finance SR \(2020\)](#), the share of university-educated employees in the sector is more than 70%, and out of the total number of jobs, the positions of specialists and management positions represent a share of 30%. Approximately 42% of employees graduated from the field of education which is optimal regarding the position they perform. Average hourly earnings in this sector in 2021 as stated by the [Ministry of Labour, Social Affairs and Family SR & Trexima Bratislava \(2021\)](#). According to the ISCP (Information System on the Price of Work) was 10 euros per hour, compared at the same time with the private sector "Information and Communication" where the average hourly earnings were 13.27 euros per hour.

3. EDUCATION AND PROFESSIONAL DEVELOPMENT OF HUMAN RESOURCES IN PUBLIC ADMINISTRATION

Human capital, accumulated through education, training, information gathering, investments in health, and investments in personal qualities, represents human potential as an economic investment. An individual's predisposition to a certain group of jobs is achieved by the assessment and compliance of the individual's human capital with the respective requirements of employers.

As stated by [Dudová \(2022\)](#) the concept of competence, as an indication of qualities of human capital, emerged in connection with the transformation of necessary knowledge into individual activities in new forms of work organization. The concept of competence gained significance in relation to the acceleration of changes in the field of work, which require the adaptation of workers to permanent changes, characteristic of the current period.

The concept of competence can be defined as a group of characteristics, attitudes, acquired knowledge and personal abilities (aptitudes) that affect excellent performance. The understanding of competence is no longer tied to a specific qualification but goes beyond it.

Digital competence is one of the eight key competences that are of fundamental importance to an individual. This competence includes self-confident, critical, and responsible use of digital technologies in education, work, and society as a whole, as well as interaction with digital technologies. According to [Ferrari \(2013\)](#), digital competences include information and data literacy, communication and collaboration, media literacy, digital content creation (including programming), security (including digital wellbeing and cyber security competences), intellectual property issues, problem solving and critical thinking.

Skills (part of competences and qualifications) and lifelong learning are key factors in terms of competitiveness, productivity, and innovation. The necessary skills must be acquired during continuous lifelong learning. Adopting digital technologies requires a digitally skilled workforce at all skill levels and across all age groups. [European Commission \(2020\)](#) stated that STEM (Science, Technology, Engineering and Mathematics) skills are essential to use new technologies in ICT and innovation. Cross-cutting skills such as teamwork, critical thinking and creative problem solving are increasingly necessary.

Education and professional development of the workforce is a continuous process of training and upskilling employees to achieve higher performance, and use their skills for the strategic

demands of the company, including training qualified employees, and profiling the professional growth of workers. In public administration, the professional education of officials is a necessity due to the turbulent environment in which they work.

The basic goal of the in-service education of employees in public administration is a high-quality, efficient, and systematic deepening of qualifications within their fields. In public administration, in-service training is a tool that conveys new knowledge and skills necessary for employees in public administration to improve the quality of work.

According to Hamalová et al. (2014), the implementation of systematic in-service education of employees in public administration consists of the following basic types:

- a) adaptation education, including adaptation initial study and adaptation preparatory study, intended for employees hired to the public administration from an external environment,
- b) deepening of qualifications, aimed at continuing maintenance, improvement and deepening of knowledge, abilities, and skills for the performance of a task in accordance with the employee's job description,
- c) specialized qualification study, aimed at the acquisition of special knowledge, abilities, and skills of the employee,
- d) retraining represents theoretical and practical training that enables the employee to maintain, increase, expand and change the previous qualification or adapt to technical development for the purpose to retain the employee in the job,
- e) functional education, aimed to acquire and develop professional competences necessary for the performance of management activities of senior employees.

The development and focus of the in-service education of managers, employees – specialists and other employees in public administration depend on systemic solutions in human resources management and the setup of institutional, legislative, and financial prerequisites for the implementation of the in-service education.

4. CRITICAL FACTORS AFFECTING HUMAN RESOURCES IN PUBLIC ADMINISTRATION

According to the Strategy of Human Resource Development in the Sector of Public Services and Administration by 2030 (2020) the factors affecting human resources in the public administration sector can be classified into political, economic, social, technological, legislative, and ecological.

Political impact in the public services and administration sector is significant. Employees whose activities are politically neutral and focused on professional performance can also be affected by political changes. The problem is the implementation of the personnel policy of representatives of the executive power at central administration state bodies.

Political expectations and demands toward the public administration sector are often contradictory, they change over time, and there is no consensus on the goals and course of public administration development.

In relation to the public administration, there are requirements to reduce expenditures on salaries, cancellation of jobs, while the differences in remuneration compared to the private sector are increasing. Because of that, much professional, sophisticated work, and human resources potential

has been transferred to the private sector. Autonomy of CEOs (top managers) in public administration organizations is low. Therefore, the selection of human resources must be depoliticized.

The economic impacts are mainly derived from the fact that the operation of a public institution is funded by public funding and the distribution of funds between individual budget lines of the state budget. Within the public sector, profit is not a determining factor, but the economic impact is demonstrated in the use of funds that make up the revenue part of the public administration budget. The economic impact is manifested by the limited funding for the adequate remuneration of human resources. The impact of political decisions on the public administration funding is high.

Social effects are mainly associated with demographic development, manifested by a predominance of older workers and a shortage of younger employees in several sectors. There is a risk of a shortage of qualified workforce, following the standard retirement rate of part of the workforce.

Technological impacts are mainly connected with the digitization of public administration, the primary goal of which is to make easier access to services provided by the public sector. Human resources are affected by newly emerged expectations for the skills and knowledge that public administration employees should possess or acquire.

Changes in the expectations of the public (changes in approach, increased degree of digitization and automation of administration) bring pressure on upgrades in process settings, software tools and agenda administration and task management, and problem solving. The population in productive age and the younger generation already understand public administration services as proactive, equipped with a high degree of automation, procedurally interconnected, comprehensible, fast, and transparent, where decision-making should be based on data and evidence. The requirements to increase knowledge and skills at work combined with the command of information and communication technologies, and mastering applications and agenda systems have become necessary prerequisites for occupations in public administration.

There is growing pressure to increase the number of employees with professional knowledge in the IT field. For public administration, the key trends are the technological areas making public administration more efficient. The use of new technologies in public administration can be slowed down by insufficient preparation of employees, financial funding, and technical equipment.

Legislative effects are linked to political factors, international agreements, and EU legislation. The public administration sector is among the heavily regulated industries through numerous legislative standards – laws, decrees, and regulations. Public administration employees are required to know and comply with all relevant legal regulations.

Concerning the ecological impacts of the public administration sector, negative impacts of a secondary nature may arise if the decisions of state authorities and public administration have a negative impact on the environment. Therefore, the control and analytical mechanisms try to prevent direct negative effects on the environment. As regards self-government, citizens strongly perceive the ecological behaviours of self-governments and the field of environmental management.

Important critical factors threatening the competitiveness of the sector include bureaucracy, the length of administration processes, insufficient funding of the public sector, a high share of

small municipalities manifesting in the performance of self-governing competences, the impact of the political cycle on public policies, higher competitiveness of the private sector in the acquisition of human resources, a negative demographic trend towards the increase of older age categories among public administration employees, an insufficient number of professionally trained employees with lower adaptability to new trends, a negative image and low profile of the public sector, the difficulty to improve the reputation of public administration institutions, a high rate of employee turnover and a non-conceptual decrease in the number of jobs.

Positive factors in the public administration development include the nationwide effects of public policies, a sufficient network of educational and training institutions, professionally developed and trained experts and specialists among human resources in the sector, the application of modern principles and procedures of human resources management, the development and implementation of long-term specific projects and relevant reforms extending beyond the election cycle, the improvement of communication, and transparency of public policies.

5. FUTURE RESEARCH DIRECTIONS

5.1. Expected Development of Human Resources in the Public Administration Sector

According to the Human Resources Development Strategy in the Public Services and Administration Sector, an increase in the number of employees in the public administration sector is expected. In the period 2021-2025, the additional demand for employees in the public administration sector should be at the level of approximately 9.3 thousand persons. According to forecasts, the expansionary demand for employees, caused by the expansion of the public administration sector, will decrease and may be zero due to the rationalization of work.

There is a strong share of employees who belong to the over-55 age group. An important challenge will be the replacement of employees, who will gradually retire by new staff. This phenomenon is most evident in the armed forces (policemen, soldiers), where many positions remain vacant for a long time.

The **Strategy of Human Resources Development in the Sector of Public Services and Administration by 2030 (2020)** stated that the identification of graduates suitable for jobs in the public administration sector is difficult because there are no universities or schools that prepare for the requirements of the public administration sector. However, it is possible to assign types of education to jobs in sectors.

These branches of education also prepare graduates for jobs that are part of other sectors (graduates with broad profiles). According to forecasts, most of the relevant graduates who will enter the labour market in 2021-2025 (approximately 37 thousand) will find employment outside the public administration sector. Therefore, by 2025, a shortage of new graduates entering the sector is expected as the influx of new graduates will be at the level of approximately 3,000 people.

Currently, different regions (counties, districts) have different quantitative and qualitative conditions in the field of human resources. In the overall assessment of human resources potentially usable in the sector of public services and administration at the district level, the influence of a large centre in the district is particularly evident. Districts that include a larger city have higher

potential, especially in terms of demographical development and education. The districts where all regional cities are located, appear to be the most perspective.

Further developments in human resources in the public administration sector will be affected by innovation and technological and process changes. The most significant innovations and innovation trends that will affect this sector are the following:

- the reduction of bureaucracy and departmentalism in public administration,
- digital transformation in public administration,
- new municipal management and new forms of inter-municipal cooperation,
- strategic planning and modern management of human resources,
- multi-channel communication with public administration,
- data integration and the use of big data in public administration,
- automation and semi-automation of processes in public administration agenda,
- smart agenda and network infrastructure development of intelligent management systems,
- shared storage and remote access to agenda and office systems,
- new methods of cyber security provision,
- an increase in cross-border interactions and the increase of single solutions in the EU,
- efficient crisis management.

Innovations that will bring changes to the public administration sector will have an impact on changes in legislation, work content, requirements for employees, the emergence of new professions, inclusion of professions and work content defined elsewhere into the public sector.

However, all changes are conditioned by a high level of normative regulation and the possibility of flexible responses to new requirements. Innovation factors that affect public administration can be divided into three areas – public administration reforms, legislative changes affecting the structure of individual job positions in public administration, external modernization and technological trends and effects.

5.2. Possible Provision for Qualified Human Resources

The basic development trends that will be manifested by 2030 in the field of human resources are based on technological, procedural and innovation changes. The following tendencies can be defined for the field of public administration:

1. professionalization of human resources in public administration,
2. digitization of public administration,
3. the increase of the competitiveness of public administration against the private sector regarding the recruitment, development, and care of human resources.

All innovation changes in public administration are conditioned by a key factor – the professionalization of human resources in public administration, which includes several measures. They include, e.g., the support of the career growth of employees in public administration through the support of internal mobility, the recruitment of the best applicants, the support of ethical principles, the involvement of the results of interdisciplinary research and the application of latest scientific knowledge in human resources development in the segment of public administration.

Furthermore, there is the development and search for talents and leaders in public administration (talent management), the connection of motivational tools (financial and non-financial with

employee in-service education and training), linkage between the requirements of public administration with the education system, the possibility to establish a national educational authority that would cover general education programs for the entire sector of public administration, separate sectoral approach that would focus only on specialized education and trainings, the sharing of qualified human resources in self-government.

Digitization and eGovernment should bring digitization of processes, performance, and service provision of public authority, cutting down bureaucracy of public administration, accelerating, and efficiency of services for citizens and business entities. It can help reduce internal bureaucracy in public administration, which can be accompanied by the centralization of selected service activities.

The process of digitization, computerization and automation in public administration can be divided into four categories – digitization of services for citizens as a tool for quality improvement of public services, digitization of internal processes in public administration and elimination of internal bureaucracy, the introduction of new IT technologies in self-government and automation of repetitive processes.

Human resources must be adapted to the digitization trend. The basis must be a strategy for the adaptation of employees to IT changes with schedule and precise procedures for the introduction of corresponding educational programs. In public administration, demand for experts from the IT sector is expected, and at the same time, it will be necessary to provide employed staff with appropriate courses and training to develop the necessary digital skills.

The public administration sector in the field of recruitment, development and care of human resources must be competitive with the private sector. In economically strong and developed regions, the public sector is confronted with problems such as a higher turnover rate, poor motivation of applicants to work in public administration, or the inability to refill vacant positions.

Therefore, systemic changes, new forms of human resources management, more flexible adaptation to the changes in the labour market, promotion of the motivation of employees in the public sector by interlinkage of remuneration with the promotion of non-financial tools of motivation, effective presentation of public administration entities as future employers (employer branding), regular assessment of employees by superiors, the introduction of work quality management and assessment systems, application of new recruitment methods are necessary.

6. CONCLUSION

The harmonization of the development trends in requirements related to human resources in public administration in the coming years will necessitate supporting the lifelong education of public administration employees, the new job positions in human resources management, the identification of insufficiently filled job positions in public administration, the strengthening of cross-sectional IT skills of employees, the focus of the in-service education of senior employees in the use of modern digital technologies and data in the public policies, the transmission of the requirements of state administration and self-government to the higher education system and update of curricula in secondary schools, involvement of pupils and students in public administration.

The Sector Council for Public Services and Administration defined the demands of individual development trends on human resources and proposed specific measures in the process and system changes, retraining, adult education, higher education (Bc., Master, PhD.), secondary education, educational and career counselling, education in elementary schools, preschool education – in the entire range of public administration institutions. Sectoral measures are interconnected with specific activities that need to be implemented to achieve the above goals.

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Integration of Foreigners in the Context of the Labor Market and of the Amendment to the Slovak Asylum Act

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Abstract: *The paper deals with the amendment to Slovak Act no. 480/2002 Coll. on asylum, which entered into force on June 1, 2022, in the broader context of the employment of foreigners. The amendment in question was adopted in response to the international situation which arose as a result of the war in Ukraine. The aim of the article is to present the purpose of the amendment and the changes it brings in an effort to unify the rules and facilitate the initial integration of incoming people. The author perceives inclusion in the labor market as one of the key factors influencing the overall quality of life, starting with the economic side and ending with a sense of usefulness and self-worth. Even with regard to the needs of the Slovak labor market, it is more than desirable that the process of applying for foreigners in various job positions is as simple as possible.*

1. INTRODUCTION

Migration is a common phenomenon in today's world – more than 244 million people currently live outside their country of origin, while up to three-quarters of them migrate voluntarily – for work, education, or a better standard of living. Refugees from war or persecution do not have this option. Running away from home is often the only option for them, and while we can return, for them returning may mean putting their lives at risk (Králíková, 2016). This fact is more relevant today in Central Europe than at any time since the end of the Second World War. Of course, there are still many people who change their place of residence in order to find new opportunities or a higher quality of life. But Slovakia is currently facing an unprecedented influx of people coming from a country threatened by an active military conflict. These are mostly mothers with children, often minors, who require compulsory school attendance and placement in a preschool if the mother even wants to think about work. Available places in kindergartens and schools are only one of the long-term unresolved problems of Slovakia. Králíková (2016) notes that for many newcomers it is a journey from scratch. Without work, housing, knowledge of the language and important social relations, help from the state is essential for their successful start. The integration process is always two-sided. It does not only concern those who should integrate, but also the majority society, which can accept newcomers without having to give up their identity. Not only the refugee's willingness to integrate, but the support of society, good policy setting, or openness of relations between people, influence the success of integration.

According to Act no. 404/2011 Coll. on the residence of foreigners, a foreigner is a person who is not a citizen of the Slovak Republic. A migrant is a person who, for any reason, has changed

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the country of their permanent or habitual residence and has moved from the home country to another country for at least three months. The Slovak legal order does not use the term migrant, but a foreigner. An asylum seeker is a person who has applied for asylum or supplementary protection in Slovakia and is awaiting a decision or who has already been granted asylum. A refugee is a person who, due to justified fears of persecution for racial, national or religious reasons, for reasons of holding certain political opinions or belonging to a certain social group, is outside the country of his or her origin and, due to these fears, cannot or does not want to return to this country. An asylum seeker is also in the Slovak meaning a foreigner who has met the criteria of the Convention on the Legal Status of Refugees, thereby being recognized as a refugee and granted international protection in the form of asylum. In the Slovak legal order, this refers to a foreigner who has fulfilled the conditions set by the Asylum Act and to whom the Ministry of the Interior of the Slovak Republic has granted asylum. Asylum is therefore a form of protection granted to refugees in Slovakia. The term supplementary protection, which is often inflected today, means a form of protection that is provided to those asylum seekers who have serious reasons to believe that they would be exposed to a real threat of serious injustice if they were to return to their country of origin. Integration, on the other hand, can be seen as a two-way process in which communities of foreigners and the receiving society get to know and influence each other. To integrate means to create a new unit by joining different parts – to unite people of different ethnic and cultural origins into one unit (society) based on equality. So we could rather talk about the creation of an integrated, cohesive society, based on jointly shared values, than about integration into the existing structures of society (Z cudzincov domáci, 2021). While integration itself is a common goal of the European Union, Member States have autonomy in creating and implementing their own legal and political framework to support the integration of nationals of third countries into the labor market (Bošelová, 2021).

According to available data, 150,012 foreigners lived in Slovakia at the end of 2020, most of them – 90,806 – from countries outside the European Union (hereinafter referred to as "EU"). The largest group from the so-called third countries for a long time – regardless of the war – are Ukrainians, followed by Serbs, Vietnamese, Russians and Chinese (Z cudzincov domáci, 2021). The number of migrants from France and the Republic of Korea has grown quite significantly in previous years, which can be explained by the influx of foreign investments from these countries (Slovak Governance Institute, 2015). Between 2004 and 2019, the number of foreigners living in Slovakia increased sevenfold (TASR, 2021). They work in industry, on construction sites, in gastronomy, as well as in multinational companies and medical facilities. They study at Slovak universities. Nevertheless, as Rojo (2021) states, foreigners often become a topic only thanks to non-governmental organizations. Understanding the system in which a foreigner finds herself or himself and the ability to provide in public institutions what she or he needs for everyday life is one of the conditions for successful integration into society. In Slovakia, this is a challenge for foreigners for several reasons. In addition to prejudices and cultural barriers, the reason is the unpreparedness of authorities and officials. Most foreigners point to the language barrier and the absence of information available in several language mutations. The state integration policy from 2014 did not at all reflect the migration waves from 2015 and 2016, and even its appropriately set parts were implemented only very slowly, while one of the biggest problems remains the unclear distribution of competences and responsibilities for the overall integration of foreigners. The Ministry of Labor, Social Affairs and Family, therefore, focuses almost exclusively on integration into the labor market; the Department of Migration and Integration at the Migration Office of the Ministry of the Interior of the Slovak Republic pays attention only to those who have received asylum or supplementary protection in Slovakia. These were very

low numbers before the war – for example, in 2020, 11 people received asylum and 27 received supplementary protection (Rojo, 2021). Understandably, with the progress of the military conflict beyond our borders, the number of people who expressed interest in staying on our territory and requested (in this case) temporary refuge increased. Many of them perceive the situation as only temporary and plan to return to Ukraine after the conflict calms down. For some refugees, Slovakia is only a transit country, but given our previous normal conditions, a still high number of people plan to stay in Slovakia permanently.

2. INTEGRATION AND EMPLOYMENT OF FOREIGNERS IN SLOVAK CONDITIONS – STARTING POINTS

Employment is a key part of the integration process (not only) of refugees. It is essential for self-realization, economic independence, but also the full integration of incoming persons into the new society. The contribution they represent to the host society is often most visible through their work (Meššová, 2021).

Already in 2009, Vašečka drew attention to the fact that Slovakia has not created good prerequisites for the success of the integration process of migrants, and the restrictive approach to them was also manifested in the legislative sphere. As an example, the law on Slovak citizenship from 2007, which tightens the conditions for acquiring state citizenship through naturalization or the asylum procedure, can be cited. In addition, foreigners are perceived stereotypically in Slovakia, and attitudes towards them are often based on slowly changing prejudices. Compared to other EU countries, we have little experience with foreigners and awareness of groups living in Slovakia is also very low. In addition, the perception of migration as a tool for mitigating the effects of the demographic crisis is still absent among the inhabitants of Slovakia – foreigners are rather perceived as a burden on the state budget. Likewise, the overall management of issues related to migration is thoughtless, uncoordinated and understaffed (Vašečka, 2009). Although it cannot be disputed that the influx of refugees in the first days and weeks after the outbreak of the conflict in Ukraine was unprecedented, this situation also showed the unpreparedness of Slovak institutions for similar scenarios when, in addition to the support of the armed forces and the police, a decisive part of the activities rested on the shoulders of volunteers and non-governmental organizations, and only later, these activities began to be covered by an authorized private company, not the state with its capacities.

The integration strategy of the Slovak Republic formally falls under the competence of the Ministry of Labor, Social Affairs and Family, which developed a conceptual document entitled "Strategy for the labor mobility of foreigners in the Slovak Republic until 2020 with a view to 2030". For this strategy, the measures are primarily aimed at nationals of third countries, since the same rules apply to the employment of citizens of the EU/European Economic Area (hereinafter referred to as the "EEA") as to the employment of citizens of the Slovak Republic, and therefore Slovakia does not emphasize the employment of citizens of the EU/EEA special legislative restrictions. Therefore, the target group of the presented strategy is not refugees or asylum seekers. The strategy focuses on the controlled (regular/legal) labor mobility of foreigners aimed at compensating for the lack of available labor on the labor market in the Slovak Republic (Stratégia pracovnej mobility cudzincov v Slovenskej republike. Ministerstvo práce, Sociálnych vecí a Rodiny Slovenskej republiky, 2018). This document – as well as previous versions: Concept of Integration of Foreigners in the Slovak Republic (2009) and Integration Policy of the Slovak Republic (2014) – tries to systematize the inconsistent and ad hoc approach to

integration applied in the '90s of the last century and the beginning of the first decade 21st century. In general, these policy proposals recognize the labor shortage in the Slovak labor market and identify several concrete steps aimed at attracting foreign labor. The employment of foreigners is governed by the third part of Act no. 5/2004 Coll. on employment services (hereinafter referred to as the "Employment Services Act"), which states what conditions must be met for a company to employ third-country nationals. Asylum seekers are subject to a different set of regulations, which largely fall under the purview of the Ministry of the Interior of the Slovak Republic (Bošelová, 2021). The field of labor mobility and integration of foreigners into the labor market in the European Union is dealt with by the Fund for Asylum, Migration and Integration, which falls under the Ministry of the Interior of the Slovak Republic and its goal is to manage migration flows and support legal migration to Member States following their economic and social needs, as well as ensuring the integrity of the immigration systems of the Member States and supporting the real integration of nationals of third countries (Kačírková, 2018).

The new migration policy in the form of the document "Migration Policy of the Slovak Republic with a view to 2025" was approved by the government in September 2021, but it is only a framework document. It also includes the area of managed economic migration, in which migration policy creates a basic framework for the arrival of foreign employees, entrepreneurs, students and academics. Emphasis is also placed on economic migration given demographic developments or, for example, the transition to a climate-neutral economy. However, according to experts, the problem, and at the same time the basic prerequisite for success, were, are and will be financial resources. As the Director of the Migration Office Ján Orlovský also points out, the lack of attention paid to the integration of foreigners is also a question of the mindset of Slovak society. Similarly, as Vašečka (2009) pointed out, we still do not see migration as an opportunity. Until these changes in the public space, it is difficult to seek support (Rojo, 2021). Regarding the employment of foreigners, statistical data is regularly published by the Central Office of Labor, Social Affairs and Family. It provides an overview of employed EU citizens and third-country nationals, divided according to whether they have been granted a work permit on the territory of the Slovak Republic or were able to work without a permit (Z cudzincov domáci, 2021). Currently, statistics are available for the first four months of 2022 (ÚPSVaR, 2022) and it is obvious that the changes in development were caused by the arrival of job seekers from Ukraine.

In terms of legislation, in connection with the integration of refugees into the labor market, the Act on Employment Services can be mentioned, both because it regulates the authorization of asylum seekers and persons with supplementary protection to enter into employment relationships, but also because it contains detailed adjusted legal relations in connection with the provision of employment services in Slovakia. Although the Act on Employment Services mentions the citizen in most of its provisions, asylum seekers and persons granted supplementary protection are considered to have the same status as citizens in legal relations under this Act. They are also entitled to access to employment without any restrictions in accordance with the principle of equal treatment and the prohibition of discrimination. In addition, the Act on Employment Services classifies persons with granted asylum and provided supplementary protection among disadvantaged job seekers, in connection with which it provides them with specific forms of support beyond the Act in order to apply and remain on the labor market. Relatively recently, Act No. 112/2018 Coll. on the social economy and social enterprises and on the amendment and supplementation of certain acts (hereinafter referred to as the "Social Economy Act"), which can also be classified as relevant legislation in the field of integration of persons entering the labor market in Slovakia. The aim of this act is to support social entrepreneurship through social

enterprises in which disadvantaged or vulnerable persons can obtain temporary employment in order to acquire working habits. With the work habits acquired in this way, they can subsequently look for permanent employment elsewhere. The Social Economy Act also includes asylum seekers and persons with supplementary protection as vulnerable persons for the purposes of social entrepreneurship. Last but not least, the regulation of labor relations, working conditions, remuneration for work performed, the scope and regulation of working hours, the right to rest, and other guarantees protecting all employees on the territory of the Slovak Republic, including refugees, are enshrined in Act No. 311/2001 Coll. Labor Code (Fajnorová & Chaloupková, 2021).

In general, the employer has a reporting obligation when employing a national of a third country. He is obliged to report in writing job vacancies, their number and characteristics of the position, to the Headquarters of labor, social affairs and family (in the case of a Blue Card application). The employer is also obliged to inform the Office of Labor, Social Affairs and Family in writing about the commencement of employment and the termination of employment of a citizen of a Member State of the EU, his family members and a national of a third country within seven working days from the date of commencement of employment and within seven working days from termination of employment (MPSVaR, 2022).

It is a widely held opinion and a repeatedly presented concern of part of the public that foreigners take jobs from residents, but practice shows the opposite. Experts agree that Slovakia is a small and open economy, where the labor market is dynamic and flexible, but integration and asylum policies have remained too rigid for a long time. Between 2013 and 2019, for example, the number of workers increased by more than 250,000, of which tens of thousands of positions were occupied by foreigners and did not displace domestic employees. On the contrary, unfilled vacancies keep breaking new records. Immigrants, more than domestic workers, fill vacancies in those occupations, sectors and regions where labor is in short supply. In this way, they fill vacancies in the labor market, improve the prospects for investments, increasing employment and economic growth. According to economists, foreigners are always at a disadvantage compared to natives in the labor market, as they do not know the language, regulations, or customs. This is also why foreigners do not push wages down. Employees from abroad often fill jobs that, for various reasons, locals are unwilling or unable to fill, thereby supplementing domestic workers. Every new worker is also a new customer and consumer. Highly qualified refugees can even increase the overall productivity and thus the wages of Slovaks. Keeping foreigners in the country brings tax revenues for public finances. In addition, Slovakia is among the fastest aging economies, which causes problems with the sustainability of public finances. The number of people of working age is decreasing and the number of retirees is increasing, which experts have been pointing out for a long time, calling on the government to find solutions and prevent future problems. Taxes on the income of working foreigners will generate money for better public services, or the first pension pillar, without the need to increase taxes or the cost of education. However, without an active approach of the state in placing refugees on the labor market, there is a risk that highly qualified workers will move elsewhere and Slovakia will rather have more difficult-to-employ people, to whom it will provide mainly humanitarian aid. At the same time, according to a recently conducted survey by the AKO Agency on a sample of 1,000 respondents, 83.8% of respondents support facilitating the entry of highly specialized foreigners into the Slovak labor market. Specifically, 61.1% of respondents think that access for specialists such as doctors, scientists, teachers, or nurses should be made easier, and another 22.7% of respondents think that it should probably be made easier (Webnoviny.sk, 2022).

Among other things, Slovakia's long-term problem is the already mentioned aging of the population. According to demographic forecasts, Slovakia will be among the oldest countries in Europe by 2060, but it is still among the countries with the lowest immigration rate in Europe (Slovak Governance Institute, 2015). The situation in Ukraine partially, and probably only temporarily, reversed this trend, but the ability to integrate incoming persons is still questionable.

As for the obstacles that foreigners have to overcome when trying to get a job in Slovakia, in addition to knowledge of legislation and orientation in the system, ignorance of the language appears to be the biggest problem. Almost all respondents of the study, the subject of which were interviews with foreigners, said that mastering the Slovak language would help them immensely in dealing with bureaucratic processes. The disparity can also be seen in the number of advertised vacancies. Of the offers active in 2021, only about 14% were written in English. Most often, these are positions in information technology, management, administration and economics, finance and accounting (TASR, 2021). Closely related to language skills is the question of whether highly qualified foreigners can find employment in jobs that match their qualifications or experience. This is a basic prerequisite for labor migration to bring the greatest possible benefits to the receiving countries as well as the migrants themselves. In general, migrants face many barriers in host countries that prevent them from finding a suitable job, and the so-called "downskilling" (Slovak Governance Institute, 2015). Asylum seekers and people granted supplementary protection also encounter many other problems. They face rejection from hostels or apartment owners, and they also encounter mistrust when looking for work. Even skin color or the traditional way they dress can decide not to be hired (Králíková, 2016). A serious problem faced not only by refugees but also by labor migrants, especially the low-skilled, is their vulnerability and threat of labor exploitation or unauthorized employment in disadvantaged working conditions. Very limited work opportunities, which they have, often force them to accept work in inappropriate conditions, contrary to the Labor Code, or even humiliation (Liga za ľudské práva, 2020).

3. SLOVAK ASYLUM LAW IN THE LIGHT OF RECENT CHANGES

In connection with the above, there appears to be an effort to amend Act No. 480/2002 Coll. on asylum (hereinafter referred to as the "Asylum Act") as a positive step towards better applicability of job seekers from the ranks of foreigners, who are currently arriving due to circumstances mainly from outside Ukraine, on the Slovak labor market. In the following section, we will describe the adopted changes to the asylum law.

The Asylum Act regulates the procedure for granting asylum, the procedure for granting temporary refuge, the rights and obligations of asylum seekers (waiting and granted), foreigners who have been granted supplementary protection, foreigners requesting temporary refuge and emigrants, as well as the competence of public authorities in the area of asylum, supplementary protection and temporary refuge, but also regulates the integration of asylum seekers into society and stay in asylum facilities. Attention is also focused on the methods of termination of asylum, as well as on the procedure for revocation of asylum, which begins at the initiative of the Ministry, or on the cancellation of supplementary protection. The Act further regulates the rights and obligations of applicants, asylum seekers and foreigners who have been granted supplementary protection. The Migration Office of the Ministry of the Interior of the Slovak Republic is the first-level administrative authority that decides on the granting of asylum and the provision of supplementary protection.

At the beginning of June 2022, an amendment to the Asylum Act came into effect, which allows foreigners to access the labor market earlier. In general, the amendment to the law systematically regulates the initial integration of asylum seekers and foreigners who have been granted supplementary protection. Further modifications arose from knowledge of application practice and the need to harmonize the legal order of the Slovak Republic with the law of the European Union. Asylum seekers will have access to the labor market already six months after the start of the asylum procedure (contrary to the nine months applied before). As the Ministry of the Interior of the Slovak Republic states on its website, the most important changes include the following:

- the hierarchy of protection statuses granted to foreigners in the Slovak Republic is adjusted – it mainly concerns the prioritization of the assessment and provision of additional protection due to serious injustice before the granting of asylum for the purpose of family reunification, but also before the granting of asylum for humanitarian reasons;
- as part of the initial integration, a one-time allowance in the amount of 1.5 times the living minimum for one adult will also be provided to a foreigner who has been granted supplementary protection;
- the provision of a new allowance for asylum seekers and foreigners who have been granted supplementary protection, namely the integration allowance, is also being introduced; it will be provided in the amount of 1.75 times the amount of the subsistence minimum, with the fact that family members living in the same household will be assessed together. The allowance will be provided for six months;
- the provision of social and psychological counseling and cultural orientation courses is established for asylum applicants based on their individual needs;
- the aforementioned deadline for asylum seekers' access to the labor market is shortened, from 9 to 6 months, which will support their integration process and enable them to obtain their funds;
- the period for which the applicant is allowed to stay outside the residence camp (so-called long-term pass) is established (MV SR, 2022).

Králiková (2016) recalls that Slovak politicians tend to say that Slovakia is only a transit country in which foreigners do not want to stay. However, as shown by the results of the MIPEX international study, which evaluates the quality of integration policies, our integration policies are currently set up in such a way that they do not even allow foreigners to fully integrate into Slovakia. The amendments to the law in question represent ad hoc legislation, which is the result of the war in Ukraine, although the need to open the labor market for foreigners has been talked about for a long time by the employers themselves, who are struggling with a labor shortage and the government has been under pressure to release the conditions when the supply of vacancies far exceeded the demand from potential employees.

In response to the military conflict, the Act also incorporated the concept of temporary refuge, which is provided to protect foreigners from war conflict, endemic violence, the consequences of a humanitarian disaster, or systematic or mass violations of human rights in their country of origin; to provide temporary refuge, a foreigner is a national of a third country according to the Act on the Residence of Foreigners (Section 29 paragraph 1 of the Act on Asylum).

Earlier, in March 2022, the Act on Asylum was amended together with the Act on Employment Services by Act No. 92/2022 Coll. on certain additional measures in connection with the situation in Ukraine (known as "Lex Ukraine"). Pursuant to § 31 par. 1 and par. 10 of the Act on Asylum, from 30.3.2022 a document of tolerated stay in the territory of the Slovak Republic

is issued to a national of a third country with the designation "temporary refuge" because this designation better corresponds to the purpose of this type of international protection. Document of tolerated stay in the territory of the Slovak Republic with the designation "expatriate" issued before 30/3/2022 is considered a document of tolerated stay in the territory of the Slovak Republic with the designation "temporary refuge". Pursuant to § 54f of the Asylum Act, an asylum seeker who is a citizen of Ukraine or a family member of a citizen of Ukraine, during the duration of the emergency situation declared in connection with the mass influx of foreigners to the territory of the Slovak Republic caused by the armed conflict on the territory of Ukraine, may enter into an employment relationship even before the expiration of nine months from the start of the asylum procedure. For the purposes of the first sentence, a family member of a citizen of Ukraine considers the spouse of a citizen of Ukraine and the parent of a minor child who is a citizen of Ukraine. The employment of this nation is in accordance with § 23a paragraph 1 letter h) Act on Employment Services (ÚPSVaRb, 2022).

4. SUGGESTIONS FOR FURTHER DISCUSSION ON THE INTEGRATION OF FOREIGNERS (NOT ONLY) IN THE LABOR MARKET

The Integration Policy of the Slovak Republic emphasizes in several places equality, equalization of disadvantages and prevention of discrimination, and clearly supports the adoption and implementation of measures aimed at suppressing manifestations of racism, xenophobia, discrimination and other forms of hatred and intolerance towards foreigners. It points out that persistent discrimination is a serious obstacle for foreigners to choose a job. However, it should be emphasized again that the Integration Policy of the Slovak Republic was adopted in 2014, i.e. before the so-called refugee wave to Europe (2015), since the social and political atmosphere deteriorated and migrants became the target of attacks, demonization and hoaxes (Fajnorová & Chaloupková, 2021).

Therefore, one of the possible support mechanisms for the integration of foreigners not only in the labor market could be the creation of a new job position: intercultural worker, primarily in public institutions and offices, especially those with whom contact is necessary in the case of foreigners obtaining the necessary documents and permits in Slovakia. We do not have to look far for inspiration – for example, in the National Occupational System of the Ministry of Labor and Social Affairs of the Czech Republic, an intercultural worker is defined as one who "provides assistance, including interpretation, in negotiations between migrants and public institutions, supports the coexistence of the majority and migrants, helps the integration of migrants and migrant communities into mainstream society" (Rojo, 2021). As the author further states, the so-called cultural mediators are active in Slovakia, and are usually brought together by the International Organization for Migration (IOM). Cultural mediators from foreign communities help their compatriots and also create space for mutual understanding between communities and mainstream society, but for now, they provide services to non-profit organizations rather than municipalities or authorities. Another of the priorities in the field of integration of migrants is "to introduce a professional subject in the study of social work, which would be focused on the possibilities of using methods of social work and social policy in the integration of foreigners in the Slovak Republic" (Rojo, 2021).

For comparison, in Finland, every foreigner has the right to complete an integration process lasting up to 5 years after arriving in the country. Part of it is language study with the receipt of a financial contribution, as well as support in finding a job, study place, or providing support in starting a business. This process is covered by the Labor Office, and help can also be obtained

from the non-profit sector. There are several organizations profiled in Finland that help foreigners with resumes, job searches, language learning, etc. Finnish companies as well as non-governmental organizations are particularly supportive of volunteer activities and internships. It is also a way to be in contact with potential employers, to get references and to practice the language, which, like in Slovakia, is often a necessary condition for performing work with a higher required qualification (Vyšná, 2021). Practice in the form of work placements has also proven itself in the integration of refugees in Norway, where it helps to reduce mutual mistrust and enables the foreigners to better orient themselves and get used to the work rules. At the same time, it is also an economic stimulus for employers. The Norwegian example thus shows that good integration policy settings can be mutually beneficial (Králiková, 2016).

In the research study by Fajnorová and Chaloupková (2021), one can find other argumentatively supported and clearly elaborated proposals of recommendations, which, after their implementation in practice, can significantly support the better employment of foreigners/refugees in the labor market. Inspiration can also be found in already tested foreign projects, which Špačeková (2014) describes in her study.

5. CONCLUSION

As stated by Vyšná (2021), migration to and within Europe is unstoppable. If we want to manage cultural clashes, it is important to solve many other things besides high-quality political leaders. For example, well-set integration processes, access to free education and enough adequate job opportunities. Policies in the field of labor market integration can only be successfully implemented if there is a strong partnership between the private and public sectors (Bošelová, 2021). Marczyová (2018) confirms the assumption that the integration of foreigners is a lengthy and demanding process that requires the active participation and cooperation of several entities: the state, organizations, and municipalities, but also individuals and foreigners themselves.

Successful integration plays an important role in the development of the Slovak Republic – one cannot disagree with this statement by Marczyová (2018). Our goal was not to analyze in detail the amended provisions of the Act on Asylum, nor to assume or evaluate their possible effects. Time and its practical application will show the impact and consequences of the new legislation. The motive we followed in the article was to present the relevant provisions of the law in a wider societal context, pointing out already known problematic areas. Currently, it is not possible to successfully predict further developments both on the domestic political and international scene, so we tried to summarize the available information on selected aspects from the last period, as the situation is dynamically changing. The domestic situation is significantly influenced by the unstable conditions in the current government coalition, the international situation is dominated by the war in Ukraine and the rapidly developing global economic situation, exacerbated by the shortage or constantly threatened shortage of raw materials and disruption of supply chains. Both scenes – national and transnational – combine attempts to find suitable solutions to deal with rapidly rising energy prices and an unexpectedly high rate of inflation.

All the mentioned factors have the potential to influence the public's attitude towards the integration of foreigners into the Slovak labor market and the support provided by the state in this regard. As analysts already predicted at the beginning of the wave of refugees from Ukraine, the potential to help will be exhausted relatively quickly, and there is a danger that public opinion will shift from seeking massive support to more or less open criticism of aid. This is already happening in

many cases. It is therefore to a large extent the responsibility of public officials and those who will implement the relevant provisions of the law in practice to communicate the need for support appropriately so that it does not provoke further unnecessary passions and does not lead to even greater polarization of society, exhausted by the pandemic, but so that it succeeds into the greatest extent possible to achieve the desired goal – a "win-win" situation, when on the one hand we as a country can provide effective assistance and create suitable conditions for those who need it and who show an interest in it, and on the other hand we also support the Slovak economy, struggling with overall labor shortages and an increasing outflow of highly skilled workers, which is currently most visible in the healthcare sector, that is at risk of collapse. An appropriately set asylum policy and measures to support integration can be an enrichment for all involved – but at the same time, whether the final result will be successful also depends on them.

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Addressing Key Challenges in Vocational Education and Training (VET) In Albania, Ensuring Systematic Change, Competence Development, and Stakeholder Empowerment

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Abstract: *The achievement of economic growth is the goal and objective of every country and it is possible only through the efforts of different educational institutions, providers, and beneficiaries, to educate and train experts in different sectors, based on the principle of lifelong learning. This paper aims to analyze the needs of employees to develop and improve hard and soft skills, providing the challenges of vocational education and to adopt the changes in the labor market, for both employees and employers. The data collected from Vehicle Services, Hotel and Tourism, Construction, and Logistics dialogue roundtables provide recommendations for providers and businesses in every job aspect.*

The analysis of the data resulted in the following: it is necessary to establish continuous contacts with public institutions which offer professional development courses for employees, both before and during employment, as for them the cost of training the employees is a continuous process.

1. INTRODUCTION

When employers intend to recruit new staff to join their company, they already know what they want, and focus on finding someone who has the skills to do the job well and can adapt quickly to the work environment. Businesses spend a significant amount of money trying to onboard new employees, as they must go through a training process and anticipate that there will be a learning curve for the employee on a new job (Jens-Henning, 2020).

This paper came as a necessity due to the lack of a study in the field of vocational education in Albania and the need to develop the hard and soft skills of employees in different technology sectors. The aim of the paper focuses on addressing the challenges of vocational education and training and also supporting the providers of this field. The goal of the study is to ensure systematic changes in vocational education due to the changes and needs of the labor market, but also to ensure the development of competence of the employees. For example, Hurrell (2009) defines soft skills as ‘involving interpersonal and intrapersonal abilities to facilitate mastered performance in particular contexts’. CEDEFOP (2006) explains that soft skills are context-dependent and attained from abstract and implied knowledge with experience and one’s reflection.

To collect the necessary data, local dialogue roundtables were set up, which brought providers together with the private sector and other stakeholders. The focus of these roundtables was to increase awareness and information exchange at the country level between education and training providers and companies, to facilitate coordination and partnership between providers and employers to reduce the gap between education and training and the world of work, to promote the development of skills required by the labor market through a participatory and comprehensive needs

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assessment process and to facilitate and increase the involvement of companies in both identifying skills and also providing new skills (Republic of Albania – Council of Ministers, 2022).

There were 4 (four) Local Skills Development Dialogue Roundtables organized, and each meeting was specifically based on different fields of expertise, as the roundtable dialogue of Vehicle Services, Hotel and Tourism, Construction, and Logistics. The actors participating in these roundtables were providers like public and non-public vocational schools, faculties in the university that offer vocational education, and vocational training centers. On the other hand, the National Agency for VET and Qualifications (NAVETQ), the Regional Employment Office (REO), the Regional Education Directorate (RED), the Industry Associations and Chamber of Commerce, the Regional Development Agency and the Directorate of Economic Development in the municipality of Elbasan, even businesses were invited to participate in these roundtables. Even though these institutions were highly interested to participate in these roundtables, not all of them were able to participate, so the roundtables were represented only by a few of them.

2. METHODOLOGY

The methodology of the paper is focused on a mixture of qualitative and analytical research. It focuses on obtaining data through communication with interested parties, in different business sectors. The meetings organized highlighted the needs of the employees working in vocational professions and the needs of the employers as well. At the end of the paper are outlined some recommendations for businesses and employers. These data were collected from a project in collaboration with Swisscontact in 2020 titled "Skills for Work". There were 4 (four) Local Skills Development Dialogue Roundtables organized, and each meeting was specifically based on the sector and the field of expertise.

The first roundtable dialogue was held with the sector of "Vehicle Services", on 03.11.2020. In this meeting participated representatives of the main public providers such as: "Ali Myftiu" Vocational High School, the Regional Directorate of Public Vocational Training Elbasan, and the University of Elbasan "A. Xhuvani". The meeting was also attended by other representatives of state institutions such as the director of the Elbasan Regional Employment Office.

The second-round table of dialogue with the sector "Hotel and Tourism" was held on 09.11.2020. In this roundtable participated: Vocational High School "Ali Myftiu", Vocational High School "Salih Çeka", Regional Directorate of Vocational Training Elbasan, and the University of Elbasan "A. Xhuvani." The meeting was also attended by other representatives of state institutions from the Elbasan Regional Employment Office and the National Agency for Training and Employment.

The third roundtable dialogue with the "Construction" sector was held on 11.11.2020. In this roundtable participated: in Vocational High School "Ali Myftiu", Regional Directorate of Public Vocational Training Elbasan, and the University of Elbasan "A. Xhuvani". The meeting was also attended by other representatives of state institutions such as the director of the Elbasan Regional Employment Office and representatives of the National Agency for Employment and Skills.

The fourth roundtable dialogue with the "Logistics" sector was held on 17.11.2020. In this roundtable participated: Vocational High School "Ali Myftiu", Vocational High School "Salih Çeka" and the University of Elbasan "A. Xhuvani". The meeting was also attended by other

representatives of state institutions from the Elbasan Regional Employment Office and the National Agency for Training and Employment.

3. RESULTS

From the discussion in each roundtable, it emerged that the number of employees and their qualifications provides the main problems of business instability and ongoing challenges which directly affect their performance in the market. Often businesses are faced with situations where they seek to add services and staff but in the majority of cases, it is very difficult for them to find people who are professionally capable to take over the management and finalization of the work given. Businesses admit that jobseekers are not skilled at the right level or find it difficult to adapt to the changes and challenges faced at any time, the demands of the workplace, and societies themselves.

Based on the aforementioned, can be accepted that it is necessary to establish continuous contacts with public institutions which offer professional development courses for employees both before and during employment, as for them the cost of training the employees is a continuous process. This contact should be frequent and the exchange of information by the parties should be as efficient as possible so that businesses can easily express their request for employees in cases where they have or are informed about jobseekers seeking employment and who are registered at employment offices. On the other hand, businesses consider that cooperation with providers should be even more intensive and they should be acquainted with their current or new offers. However, the quality and qualification, training of young people in certain profiles, adapted to each sector remain the most urgent problems for this sector in the region of Elbasan.

4. CONCLUSION

Not only in Albania but worldwide, the labor market is changing very fast. Due to the phenomenon of migration, workers must have developed skills that are more useful not only to employees but even to employers who want good results in a short period. To do so, both employees and employers must collaborate to be able to adopt the requirements of the market and to improve a lifelong learning capacity.

On the other hand, besides the investors and businesses, a crucial role in this process plays the government and governmental institutions when making decisions regarding the resources, training, and policies to meet competing development needs. With these interventions from a very early stage for vocational education, students and workers should be more effective later on.

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How Much Sustainable Knowledge Will Soon-to-Be Experts in Slovenia Have? Findings of Higher Education Study Programs' Analysis

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Abstract: Environmental topics are gaining more and more important both in the European Union and in Slovenia in the last decade. Climate changes (floods, droughts, and heat waves), pollution (soil, water, and air), management of invasive species, noise pollution, food self-sufficiency, sustainable development in the field of tourism, etc. are particularly present both in Slovenian Eastern and Western cohesion region. However, the level of knowledge about environmental challenges and competences of current experts and leaders to effectively manage and deal with them is perceived to be too low. The paper examines the inclusion of sustainable competences, knowledge, and skills in higher education programs in Slovenia to predict the level of sustainable knowledge. Slovenian soon-to-be professionals will be empowered by the Slovenian higher education system (Daneshjoo et al., 2020). Analysis included the content of 956 higher education study programs on the individual course level. In the next phase, a comprehensive comparative analysis of the situation in the areas of higher education and environmental education was performed. The factors based on which comparison was made are field of study, type of institution, level of study and number of subjects in the program that include some sustainable content. Non-parametric tests were used to determine statistically significant differences are the Mann-Whitney U test and the Kruskal-Wallis H test.

1. INTRODUCTION

The doctrine of sustainability science is widely acknowledged as a tool for attaining global sustainability and is becoming the core philosophy of national and international developmental agendas, also as a part of the United Nations Sustainable Development Goals (SDGs) that acknowledges the role education plays in the promulgation of Sustainable Development (SD) by acting as a thread that concatenates the other SDGs. Hence, it is gaining global popularity as an academic discipline (Piza et al., 2018; Priyadarshini & Abhilash, 2020).

2. LITERATURE REVIEW

Higher education for sustainable development addresses ill-defined, highly-complex real-world problems, such as climate change, pollution of environmental media, exhaustion of resources, overproduction of phosphorus and nitrogen, biodiversity loss, or unjust distribution of wealth as well as circular and shared economy and de-growth. The relevance of the topic is recognized within the United Nations SDGs (United Nations, 2015). As a part of SDG 4 (quality education), Target 4.7 states “that all learners acquire the knowledge and skills needed to promote sustainable development, including, among others, through education for sustainable development and sustainable lifestyles, human rights, gender equality, promotion of a culture of peace and non-violence, global citizenship

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and appreciation of cultural diversity and culture's contribution to sustainable development" (United Nations, 2015). In general, there is a broad understanding that higher education plays a crucial role in the transformation of studies and society toward a more sustainable development paradigm (Barth & Michelsen, 2013; Benton-Short & Merrigan, 2016; Viegas et al., 2020). Thus, higher education for sustainable development needs to be transformative in the sense of challenging world-views, assumptions, and values we as a society hold (Brudermann et al., 2019; Howlett et al., 2016).

Researching relations of education for SDG was already done by Kopnina (2020). Despite the willingness of many educational institutions worldwide to embrace the SDGs, given escalating sustainability challenges, their research questions examine whether SDG no. 4 is desirable as a future education for all. Many challenges outlined by the SDGs are supposed to be solved by "inclusive" or "sustainable" economic growth, assuming that economic growth can be conveniently decoupled from resource consumption. Yet, the current hegemony of the "sustainability and growth" paradigm has increased inequalities and pressure on natural resources, exacerbating biodiversity loss, climate change and resulting in additional social tensions. Therefore, paradoxes of sustainable development need to be defined and teaching for sustainability should also consider various examples of alternative education (e.g., indigenous learning, ecopedagogy, ecocentric education for steady-state and circular economy, empowerment and liberation) that emphasizes planetary ethics and degrowth.

One such case can be identified in increasing student internationalization that increases the availability of sustainability education especially for students from lower-income countries (Bell et al., 2020) but demands them to fly frequently and consequently be less sustainable. This has however changed recently with online studies. Lack of interest in the staff for improvements might also be challenging (Eppinga et al., 2020).

The topic gains importance in recent years which can also be seen in the steep increase in the number of related publications. All studies are more or less concise – the lack of environmental and sustainability education and the development of new innovative frameworks to improve it can be seen all over the world (Brudermann et al., 2019; Daneshjoo, K; Haghighi, HM; Talei, 2020; Daub et al., 2020; Do, 2020; Eppinga et al., 2020; Glavič, 2006; Vagnoni & Cavicchi, 2015; Valderrama-Hernández et al., 2019). However, this is especially true for the Global South (Ulmer & Wydra, 2020). Not just the quantity of programs and courses but the way how we teach should significantly change to allow us to get to a more sustainable future (Kopnina, 2020; Wamsler, 2020). The increasing importance of sustainability education is visible in changing university degree catalogues to make sustainability focus more visible to students and their future employers (Zorio-Grima, 2020).

Research on sustainability education has neglected to integrate entrepreneurial skills into other relevant competencies such as foresight, complex problem-solving, and interdisciplinarity. Education for sustainable development (ESD) is a key element of the 2030 agenda for sustainable development. Its aims form one of the targets of the sustainable development goal on education SDG 4.7 (Sustainable Development Goal) and it is considered a driver for the achievements of all 17 SDGs. Eight key competences in sustainability are (The Competences in Education for Sustainable Development, 2012):

1. Systems thinking competency,
2. Anticipatory competency,
3. Normative competency,

4. Strategic competency,
5. Collaboration competency,
6. Critical thinking competency,
7. Self-awareness competency,
8. Integrated problem-solving competency.

3. MATERIALS AND METHODS

The analysis included the content of 956 Slovenian higher education study programs on the individual course level. In the next phase, a comprehensive comparative analysis of the situation in the areas of higher education and environmental education was performed. Keywords were addressed at examining course topics and content. The sustainability score of the proposed program was calculated as a score of 6 keywords determined by a group of experts in the field of sustainable development: 1) “green/environmental”; 2) “environmental protection”; 3) “sustainable development/sustainability”; 4) “circular (economy)”; 5) “ecology(-cal)”; 6) “social responsibility” and related acronyms and synonyms. The factors based on which comparison was made are field of study, type of institution, level of study and inclusion in the name of the subject. Non-parametric tests were used to determine statistically significant differences: Mann-Whitney U test and Kruskal-Wallis H test.

Analysis was made for all three study degrees (bachelor, master, and doctoral) and was investigated according to 9 study fields classified by CLASIUS-P (1. Educational science and educating teachers (professors); 2. Art and humanities; 3. Social, business, management and law studies; 4. Natural science, mathematics and computer engineering; 5. Technics, production technologies and construction; 6. Agriculture, forestry, fishery, veterinary studies; 7. Health and social care, 8. Services and 9. Unclassified). Data were collected for public universities and faculties, applied science universities, private faculties, and high schools. Class “Unclassified” (CLASIUS-P no. 9) was excluded from the survey since no study program was defined as class no. 9 – “unclassified”.

Courses within study programs were further investigated to define the three most frequent and three less frequent topics related to environmental sustainability and to identify which topics are currently seen as a priority in environmental sustainability-related subjects. Cross-sections were also investigated to see which topics are well interconnected and which still lack strong interconnections.

4. RESULTS AND DISCUSSION

To investigate statistically significant differences among different study programs which belong to different Klasius P-16 fields, Kruskal-Wallis H test was performed. Statistically significant differences were found ($\chi^2=52,965$, $p<0,01$). According to the Mean Rank values for different groups of study programs, we can conclude that the most sustainable contexts can be found in Slovenian HEI programs from the field of arts and humanities, services and environmental safety as well as engineering, manufacturing technology and construction while the less sustainable contexts can be found in study programs related to health and social work (Table 1).

To investigate statistically significant differences among different study programs on different study levels, Kruskal-Wallis H test was performed. Statistically significant differences were found ($\chi^2=11,947$, $p<0,01$). According to the Mean Rank values for different groups of study programs,

we can conclude that the less sustainable contexts can be found in Slovenian university programs; all other levels have an approximately similar level of sustainable context (Table 2).

Table 1. Kruskal-Wallis H test results: field of study

Kruskal-Wallis H	KLASIUS P-16	N	Mean Rank
52,965**	education	22	454,64
	arts and humanities	12	740,17
	social business law and administrative sciences	149	497,06
	natural sciences, mathematics, computer science	342	446,2
	engineering, manufacturing technology and construction	209	517,79
	agriculture, forestry, veterinary, fishing	121	419,4
	health and social work	19	257,21
	services, environmental safety	82	585,96
	Total	956	

Source: own research

Table 2. Kruskal-Wallis H test results: level of study

Kruskal-Wallis H	Degree programs	N	Mean Rank
11,947**	Professional	253	498,25
	University	249	428,39
	Master	309	489,94
	Ph.D.	145	505,72
	Total	956	

Source: own research

To investigate statistically significant differences among different study programs taught in private and public institutions, the Mann-Whitney U test was performed. Statistically significant differences were found ($U=63734,5$, $p<0,05$). According to the Mean Rank values for different groups of study programs, we can conclude that statistically significant more sustainable contexts have study programs taught in private institutions compared to study programs taught in public institutions (Table 3).

Table 3. Mann-Whitney U test results: type of institution

Mann-Whitney U	Type of institution	N	Mean Rank	Sum of Ranks
63734,5*	Private	185	519,49	96105,5
	Public	771	468,66	361340,5
	Total	956		

Source: own research

To investigate statistically significant differences among different study programs having at least one subject includes at least one keyword in the name of the subject, the Mann-Whitney U test was performed. Statistically significant differences were found ($U= 71305,5$; $p<0,05$). According to the Mean Rank values for different groups of study programs, we can conclude that statistically significant more sustainable contexts have study programs having at least one subject with at least one previously defined sustainable keyword compared to study programs that do not have it (Table 4).

Table 4. Mann-Whitney U test results: inclusion in the name of at least one subject

Mann-Whitney U	Inclusion in the name of at least one subject	N	Mean Rank	Sum of Ranks
71305,5**	no	415	379,82	157625,5
	yes	541	554,2	299820,5
	Total	956		

Source: own research

5. FUTURE RESEARCH DIRECTIONS

In reviewing study programs and the subsequent analysis of the obtained data, it was possible to detect extremely large differences between study programs and specific HEIs. This was noted among HEIs within the same University and even more among the different public or private HEIs in the Republic of Slovenia. On the one hand, this result is logical, as the HEIs are primarily focused on specific areas of the economy; on the other hand, such diversity is challenging and requires better insight into the integration of particular topics for future graduates of specific fields. Graduates of some HEIs or study programs can be much better acquainted with environmental sustainability than others, i.e., graduates of comparable programs and degrees of other HEIs. It was also revealed that in private HEIs, there are fewer subjects related to environmental and sustainability-related topics. However, the number of study programs among private HEIs is also considerably lower. Given the legislative framework and direction of EU development and its research programs, including funding of priority research and study areas, it is expected that environmental sustainability topics will be at the forefront due to the focus of Horizon Europe (2021-2027) and its funding opportunities related to the circular economy, sustainable development, alternative resources, and smart and resilient society.

A study by [Mróz et al. \(2018\)](#) revealed that sustainable development promotion and teaching are not among the priorities and therefore, teachers/professors are not well prepared to use them in teaching/lecturing. We can see that according to a comprehensive and detailed analysis of Slovenian HEIs, there is already low to medium inclusion of environmental sustainability-related topics in most of the study fields. However, some study fields and programs are lacking regarding sustainability education. While sustainability and “green” business are being set as a top priority of the EU strategy for 2019-2024 and after the COVID-19 crisis recovery, further promotion of sustainability education is needed to fulfill this objective. This is only possible if current students and future managers are about to become more aware of environmental and social challenges, gain knowledge on how to address them and be able to create sustainable and resilient business opportunities, a sustainable public sector, and transform society on the road towards more sustainable oriented development paradigm.

6. CONCLUSION

The presented results identified crucial fields that were urgent to be approved. In the first phase, all university study programs in Slovenia should upgrade at least 5% of its contents with sustainable content. This should be made as an offer of at least one subject including content related to the sustainable transition. In the second phase, more attention should be given to the study programs taught in public universities with no subjects with sustainable contexts. Last but not least, more attention should be given to the Klasius P-16 study fields with less sustainable contexts. A minimum of at least 5 % of sustainable development contents subjects should be an integrative part of all HEI study programs in Slovenia, so more attention and support should be given to the fields that currently do have not them (for example programs related to health and social work).

Based on study findings, it can be recommended to establish a smaller "organization" or council for the systematic and continuous monitoring of priority topics integrated into higher education study programs and the preparation of an improved database of what is taught within specific courses and study programs. This should not be done only on the level of HEIs but also

regionally monitored and diversified among public and private HEIs. It is also more than welcome to encourage interdisciplinary teaching, including different aspects of environmental protection and sustainable development into full-time study programs of all kinds and integrating at least one elective course tied to environmental sustainability into each study program. This would enable all interested students to deepen their knowledge in sustainability science no matter what their primary study focus is. Since creating new subjects and hiring sustainability experts might be expensive and irrational for small HEIs, one solution is also seen in the implementation of joint projects and elective subjects throughout study programs that would need sustainability science integrated into their curricula to transfer knowledge to HEIs without strong integration of sustainability education. This solution is also suitable for the HE system since it does not bring high additional costs for the HE studies system.

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The Need for Coherent Educational Policies in School Institution Management

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Abstract: *The presentation aims to emphasize the acute need for the existence of coherent educational policies in educational institution management. It is anchored in the concrete example of these concerns in Romania in recent decades. Pre-service and in-service training of school managers is argued as a necessity. A possible professionalizing of this occupation is highlighted, following examples derived from a brief presentation of the problem in the world. A curricular approach aiming at educational managers' training within a concrete program of master's studies existing at Transilvania University from Braşov is presented synthetically. Some universally valid aspects of this training are highlighted. The presentation stresses the idea that all these aspects must be understood in depth both by the educational policymakers, by the curriculum designers, and by those who implement the respective curricula. Awareness and accountability in this field increase the effectiveness both of school managers' pre-service training and implicitly the quality of the educational approach at all levels of the education system, from early education to higher education.*

1. INTRODUCTION

The educational phenomenon is a social phenomenon of development, formation, and building of people as subjects of action, knowledge and values, through communication and exercise, through shaping their behavior and integration into activity and social relations.

The educational phenomenon takes place implicitly and explicitly in society and takes three forms of education: formal education, non-formal education, and informal education (Niculescu, 2007, p. 22).

In this context, educational management implies a concrete form of leadership focused on the educational process, organized explicitly in school institutions or other types of institutions, including the family.

2. THE NECESSITY TO DEFINE SOME KEY CONCEPTS

The core concepts implied in this paper are intensively used in the literature, but sometimes with differences in their meaning. This is the reason for a brief presentation of the meanings of their use within this paper.

School leadership workforce realities require taking a new approach to attracting, supporting, and keeping principals. In addition to traditional managerial responsibilities such as coordinating

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school building maintenance, organizing schedules, and taking inventory of curriculum, a critical role of today's principal is as the instructional leader (George W. Bush Institute (2016).

Talking about educational institution management, we must focus on the essential role of school leaders; so, we have the manager / the leader.

In Seven Steps to Efficiency, Stephen Covey quotes Peter Drucker and Warren Bennis as stating: managing implies doing things right; leading means accomplishing the right things. Let's examine what defines the manager/management and the leader/leading (Stephen R. Covey Quotes. (2012).

Manager and leader are two concepts sometimes used as synonyms but distinguished by specific notes, being different concepts, the words manager and leader are metaphors representing the two extremes of a continuum. The manager tends to represent the extreme of the continuum that focuses on the aspects: analytical, structured, controlled, deliberate, ordered, and the leader tends to represent the focus on the aspects: visionary, experimental, flexible, with less rigorous control, creative (Niculescu, 2002, p. 1).

The manager is often more seen as the strategist because he must evaluate the previous managerial cycle and prognosis (for establishing a mission according to a shared vision); he is also in strategic planning; he does the macro-level organization and the final macro-level assessment, as well as makes decisions and provides circulation of information.

The leader establishes: operational management, works with people (at the tactical level), details the strategic planning in sequences or areas, forms teams, leads operationally, prevents / resolves conflicts, evaluates sequentially and motivates people.

We can conclude that the manager is the person who uses his mind to solve the perspective and current problems of the organization he leads, and the leader is the person who brings emotional experiences to the management activity to support solving the same problems (Niculescu, 2002, p. 1).

Thus, management involves climbing the ladder of success; leadership means putting the ladder on the right wall.

Building and maintaining effective schools' institutional management depends on having talented leaders. This is especially true for schools, where strong principal leadership is critical to promoting student achievement.

According to research, principals are second only to classroom instructors in terms of importance as a school-level factor determining students' academic attainment (George W. Bush Institute, 2016, p. 4).

Quality is an issue important to be considered in all human areas of activity and in education as well. Thus we are talking about the quality of the educational process on all levels of the educational system, the quality of human resources in education: teachers as educational managers and principals/directors/presidents/deans / as institutional/organizational managers, and quality management as a specific aspect.

The literature and mainly the practice raise a sensitive question: *could quality assessment in education be a necessity or a burden?* The answer is complex that involves the purpose and the way of doing this in the practical field. A likely answer could be highlighted by the following brief ideas. Quality assessment is a must in education, but it should be done wisely, focused on core aspects, and using relevant and easy-to-implement tools. Some core issues involved are: *evaluating the design* of the activity at all its levels (documents) together with the *achieved results in the field* and *evaluating the optimal strategic approach*.

The practice shows that the way the quality assessment is done now determines the perception of it as a burden. The reality shows that tons of papers are produced about quality, that an impressive number of commissions and committees are “stacked” with decisions in order to deal with quality, and an even more impressive number of files are lined up nicely on shelves to be “checked” by those who do quality audits.

The question is ” what” means the *effectiveness behind* these? Three phases/levels of training are considered in relation to managerial status and roles generally and, in this context, those in the educational field.

The question is what means the effectiveness behind all of these? We think that managerial action must be taken to avoid what the reports show, that all those efforts of writing papers and so on are without sense.

Pre-service training (preliminary training) shows preparation for actually assuming the role before holding the status that entails that role.

In-service training involves the preparation to fulfill the role of holding a managerial status after assuming this.

Continuous training implies consistency between the previously specified forms in successive updating stages.

3. A CONCRETE EXAMPLE OF CONCERNS ABOUT EDUCATIONAL MANAGERS' TRAINING IN ROMANIA AND THE WORLD IN RECENT DECADES

There were no explicit theoretical concerns for managerial aspects of education in Romania, before 1990. Some so-called continuing training programs for school directors could be found. They were a kind of in-service training approach for the already-named directors. Without pre-service training, it is not what to be followed up on.

The interest was slowly born in the 90s of the last century. In 1995, a doctoral thesis was defended at the University of Bucharest with a topic belonging to the field: Long, Medium, and Short-Term Strategies for Educational Managers' Pre-service, continuing, and in-service training. Its author, a scholar from the Universitatea Transilvania of Braşov, was also the first trainer of a group of school managers from Romania in a summer school – for 41 directors of Teachers Centers directors (Casa Corpului Didactic). The trainer was Professor Rodica Mariana Niculescu.

After this initiative, more and more concerns emerged in this area all over the country.

At the *Transilvania* University in Brasov, prof. Rodica Mariana Niculescu, the first Dean of the Faculty of Psychology and Educational Sciences, started the first decade of this century a program aimed at pre-service training through a master's degree for school managers.

Such programs have developed in several universities in the country. Later, multiple *continuing training programs* were developed for school managers at different universities in the country. Now we can speak about a serious concern in the field.

4. PRE-SERVICE AND IN-SERVICE TRAINING OF SCHOOL MANAGERS IS A GENUINE NECESSITY

A lot of debates in papers, and conferences show and argue the necessity of pre-service training of school managers/institutional or organizational managers named differentially over the world (principals, directors, heads, etc.)

University or other principal pre-service training programs should recruit and select only aspiring leaders with the desire and potential to become effective principals in local schools (Turnbull et al., 2013, p. 12).

According to Kelly Garrett (Executive Director of The Rainwater Charitable Foundation): *The job of school principal may be one of the toughest in our nation—and one of the most valuable. High-quality school leaders are in great demand and there are strong calls for principal preparation programs to meet the need more effectively. If we want to turn around our schools and improve student achievement for all children year after year, we must address this leadership challenge* (Gretchen et. al., 2010, p. 8).

Capable leaders are crucial to establishing and keeping powerful organizations, and this is especially typical in schools, where principal leadership is essential to raising student progress. According to research, principals seem to be the second extremely important school-level part in determining student achievement following classroom teachers (George W. Bush Institute, 2016, p. 2).

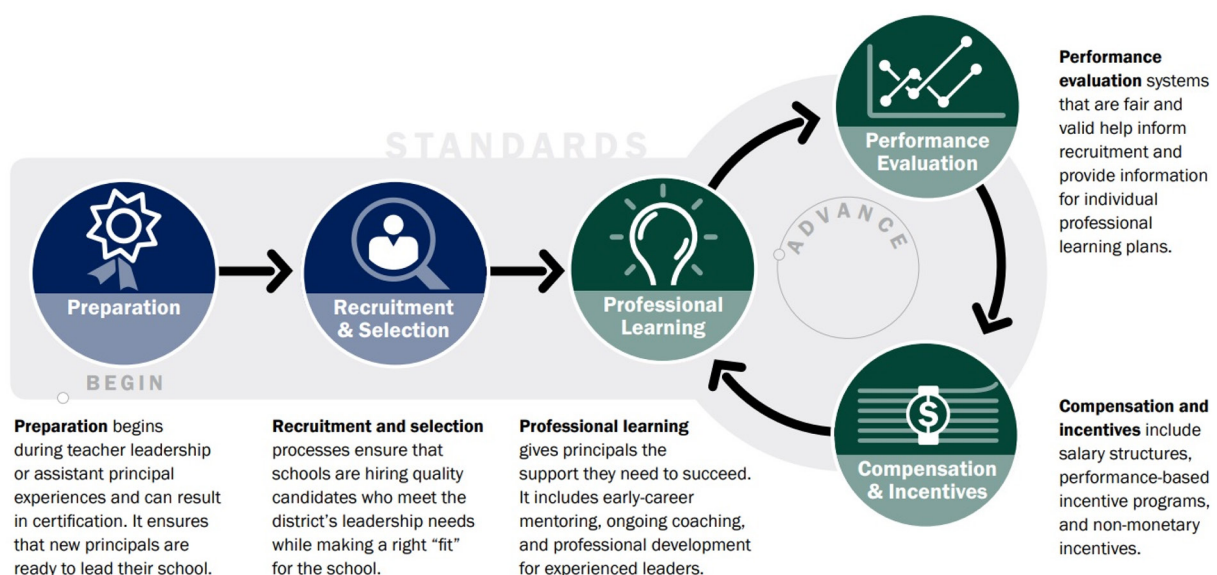


Figure 1. A Framework for Principal Talent Management

Source: George W. Bush Institute, 2016, p. 3

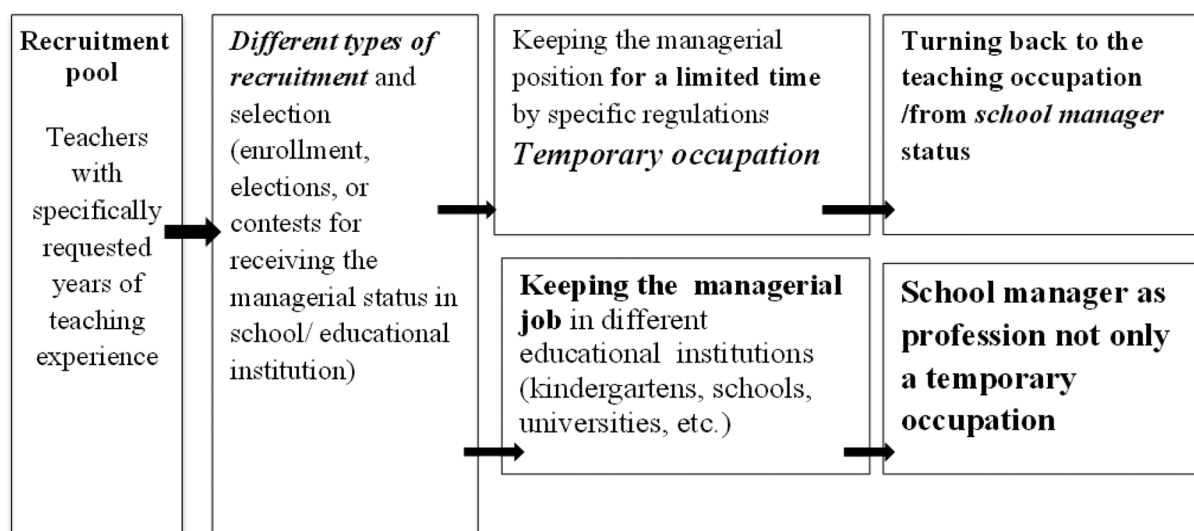
Just as any other leader, an efficient principal plays an essential role in recruiting and keeping the top professors, setting ambitious objectives for their schools, and encouraging an attitude of partnership and sustained development.

It is the combination of *highly effective teaching* with *highly capable school leadership* will change outcomes for children in our schools—not one or the other but both (Gretchen et. al., 2010, p. 10).

5. MANAGING A SCHOOL OR AN EDUCATIONAL FIELD – A PROFESSION OR A TEMPORARY OCCUPATION?

An important question is raised whether managing a school can be regarded as a profession or a temporary occupation? Some important steps to becoming a manager of an educational institution are to be mentioned.

The following figure highlights these steps:



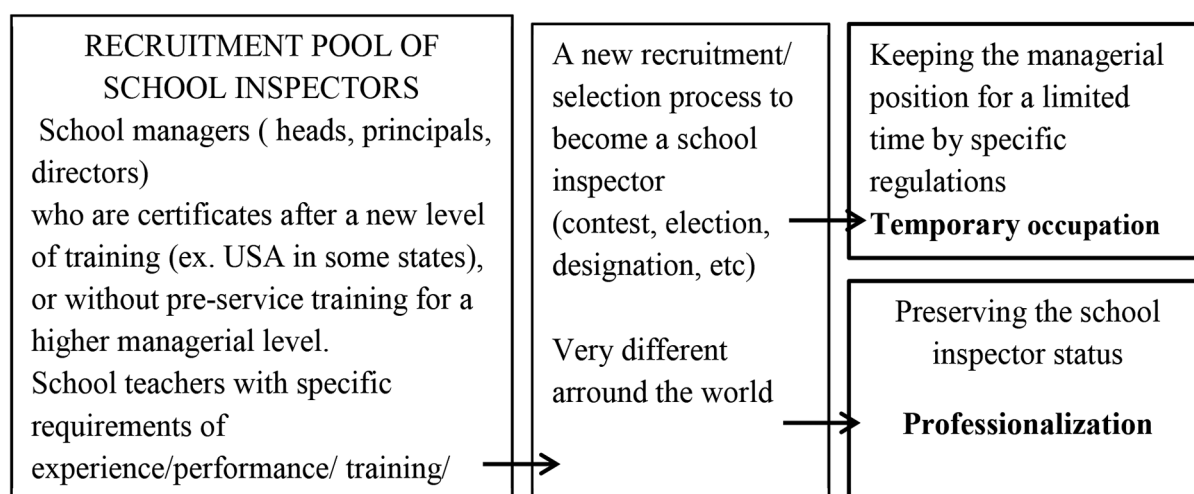
The recruitment pool is based on teachers with specifically requested years of teaching experience. From one state to another, there are distinct types of recruitment and selection (enrollment, elections, or contests for getting the managerial status in school/educational institution). But we can identify a two types of managers who consider this position temporary or a profession.

The recruitment pool is based on teachers with specifically requested years of teaching experience. From one state to another, there are distinct types of recruitment and selection (enrollment, elections, or contests for getting managerial status in school/educational institution). We can identify two types of managers who consider this position temporary or a profession:

1. Keeping the managerial position for a defined time by distinct regulations is specific for a temporary occupation; the dominant characteristic is turning back to the teaching occupation / turning back from school manager status to educational manager one (teacher as a manager of the educational process with direct contact with the students).
2. Keeping the managerial job in different educational institutions (kindergartens, schools, universities, etc.) for a long period; this type of managerial job illustrates that the school manager performs this as a profession, not merely a temporary occupation.

There are two routes for a school manager. The first one is the one of a temporary status as an institutional manager in education and the second implies the professionalization for the status of manager in an institution of education (kindergarten, school, high school, university on different internal levels: top or medium management level). These two ways can be found in different meridians of the world.

The status of school inspector (differentiated in different spots of the world) is also reached following distinct steps, essentially represented by the following figure.



Concerning the recruitment pool of school inspectors, the recruitment/selection process to become a school inspector is certainly different around the world (thinking about the contest, the selection, the designation, and so on).

School managers (heads, principals, directors) can be certificated after following a new level of training (in university or other institutions as happen, for example, in the USA, in some states, or other countries). They can also receive this status without pre-service training for a higher managerial level following other routes of retreatment selection. School teachers may have specific requirements of experience/performance/training.

School inspectors can receive this status, like in the school manager's case, both for a defined period or as an achieved profession. So, keeping the managerial position for a limited time by specific regulations describes this position as a temporary occupation, or keeping permanently this status in different working places presumes that is a high level of professionalization.

These two ways can also be found in different meridians of the world. The issue of professionalization for the managerial status in educational systems around the world remains a controversial one.

6. THE SYNTHESIS OF THIS CURRICULUM INVOLVED IN THE MASTER'S DEGREE PROGRAM, EXISTING AT TRANSILVANIA UNIVERSITY FROM BRAȘOV

An important phase of designing this program was the analysis of necessity and the comparison of models existing in the world, considering the balance between their aim and the specific cultural context of their functioning. The second phase was that of establishing aspects to be

considered in designing the new master's program, considering the local aims and the specific Romanian cultural context.

Thus, common issues found in similar programs from abroad have been considered for two kinds of reasons:

- (a) ensuring similar training for managers of similar educational institutions. This is the condition for the effectiveness of the human resources movement specifically nowadays;
- (b) ensuring the possibility of students' motilities during the training for widening their vision.

From the methodological point of view, the program implemented metaphor and drama. These methods were constantly and effectively used within the teaching and assessing sequences; presentations of these aspects could be found in papers published in the Journal Plus of Education.

Some universally valid aspects of school managers' training are considered in the master's program. They are connected to several well-known concepts and managerial issues.

Good managers should be able to define and customize the generic mission for their own institution, understand the generic mission of the type of managed institution, and adjust it to the actual condition of the school environment. They must have a clear vision of the institution in the education system and the role of the organization as the engine of any institution. An effective person in a management role should act as both a manager and a leader. The person in charge must know how to choose collaborators in that area of activity where he needs support if one side is less strong.

A short selection of topics/ issues from the training program courses shows some essential topics. The designers of this program understood in depth the meaning of the school's effectiveness when it is to performance in education, the necessary balance between the effort made to educate the generation/individual in a generation, and the effect got and reflected by the level of training of the graduates.

They approached the way to *scrutinize everything that was done as a school manager, self-management being an important section of training. From this point of view, the approached issues are the managers' responsibilities as self-manager and managers and leaders of others.*

Self-management is very important and the first condition for effective management is highly controlled self-management. A lot of topics are related to self-management and need to be carefully analyzed by everyone who wants to be a good manager, like time management (is important to think carefully before every action), stress management (with an accent on causes, symptoms, possible ways of solving), assertive behavior (to be strong/explicit / firmly / wise / in control, not influenced), team management, conflict management and managing meetings.

Management of time, stress, the assertive behavior are topics of interest within the training program. The entire issue of self-management is considered *a difficult "road" but a necessary condition of the quality of managing others.*

Conflict prevention and resolution is a delicate issue for any manager, so he can follow a few steps in finding solutions: recognizing the genuine conflict and making the difference between conflict and dispute of ideas; understanding the causes of the conflict; action against causes

– prevention of an open conflict; opening an inevitable conflict and managing the resolution by putting together the actors and facilitating the negotiations – solving conflicts; concluding to further preventing further conflict solutions.

Another essential idea is that the manager and leader should act as effective team builders, which means taking into consideration some important rules:

- clear goals, well-defined priorities, well-structured and shared tasks, and responsibilities;
- frequently analyzed and reviewed actions;
- open communication lines are obvious;
- ensure the development of each member as a condition of the effectiveness of the team;
- acceptance that disputes of ideas are sources of success and they are not avoided if occur;
- team leader and team members are in consensus;
- team acts in a trusting and opened to help the climate.

The educational / school manager (head of school or teacher) is faced, in his activity, with the need to know and exercise an important number of managerial functions:

- 1) Functions with sequential and consecutive action during a reference managerial cycle:
 - a. functions centered on the size of the task: analysis-diagnosis; organization (made at the beginning of the managerial cycle but with action throughout it); design (planning and programming); program implementation (operational management, control, sequential evaluation); final assessment.
 - b. functions centered on the human dimension: organization of groups (performed at the beginning of the managerial cycle but with action throughout it); team building.
- 2) Functions with constant action throughout the managerial cycle:
 - a. functions centered on the task dimension: decision; the circulation of information (the need to build the alternatives involved in decision-making);
 - b) functions centered on the human dimension: motivating people; participation, personal development of each individual; the negotiation; preventing and resolving conflicts. (Niculescu, 2002, pp. 8-9).

From the point of view of the institution and organization management, serious attention has been focused on the in-depth understanding of the action of managerial functions within a managerial cycle.

The issues of conflict management, people's motivation and personal development, meeting management, and the promotion of the educational institution within marketing dimensions have an important place in training not only from the theoretical point of view but as aspects of the educational practice. Using the mentioned pedagogical methods together with others like building and analyzing cases or specific methods of critical thinking always connected to real life, the program ensured an anchor of the managers training into reality.

7. CONCLUSION

The school management is basically where the managers adjudicate school operations and daily tasks of colleges. The duties of a manager at a school vary depending on the school, however, the essential requirements are the same for all organizations. In the particular case of the school manager, he works for the growth of the students and the employees and designs a plethora of activities to develop the level of education of the kids/students.

In conclusion, the action of managerial functions and the quality of their manifestation in the organization's structure largely depend on the manager. A genuine school manager should be well-trained to act for the benefit of the well-being of the staff room, for a positive and stimulating school climate. The school or the educational area managed by a school manager or an inspector should please the community, which can easily become an effective partner. All these are determined by properly trained managers and happy direct beneficiary users, kids, young students, teen students, and adult students.

In an educational institution, the head of its life is highly important. The school manager is important both to open the kid's eyes to the beauty and importance of education when he or she just entered an educational institution and to keep an open door for the old teachers who served the school their entire lifetime.

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Educational Policy and Education Management. Study Case: Israel

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Abstract: *The world today faces new realities, conditions, and challenges as a result of the remarkable development in many fields. Across the past century, education systems all over the world have seen significant improvements. The educational system has evolved, progressed, and transformed in a way that emphasizes the democratization of education. To adapt their educational systems and objectives to the 21st century, all developed nations are coping with and confronting changes and difficulties both locally and globally. The present article wants to present some specific aspects related to educational policy and education management in Israel. Israel is a relatively new state, found in 1948 and the Israeli educational system reflects Israeli society, similarly to anywhere else in the world. In all these years of existence, Israel's educational system has accomplished prodigious achievements. As it is obvious, Israel is a relatively young nation, hence its educational system faces various challenges, some of which are exclusive to Israel. This presentation proposes to explain briefly the roots of Israel's education system, which began before it was recognized as a state, and will illustrate some concrete facets of the actual education system, educational policy, and education management, as well, as in Israel.*

1. INTRODUCTION

Israel or officially called the State of Israel, in Hebrew (Medinat Yisra'el) is a relatively small country situated in the Middle East. Its northern border is with Lebanon, Syria is in the north-east of the country, Egypt is to the southwest, Jordan is to the east and southeast, and the Mediterranean Sea is to the west. Jerusalem serves as both the country's capital and its seat of government, even though the city has not received widely spread global recognition. (Britannica, n. d.)

The historical past of the Jewish people shows the persistent need to develop a quality educational system. For about 2000 years, the Jewish people were living in the diaspora, having an important role in the development of culture. Over the years, Jews became educators in Europe and other parts of the world. At the beginning of the 20th century, with the inception of the British Mandate and the possibility of the Jews returning to Palestine, there appeared the desire for Jews to develop their educational system. Although around the 1900s, the creation of the State of Israel still seemed like an impossible mission. This desire could have been accomplished in several ways, one of these ways was through the development of successful institutions. This development of society, as well as the desire of more and more Jews to return to Palestine, began with the Russian Revolution of 1905 and the Russian pogroms that began as early as 1903.

As author Shlomo Lambroza stated, Russia has never been a good and friendly place for Jews. This aspect was more visible in the twentieth century. However, the first wave of pogroms

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against the Jews began in 1881, shortly after the assassination of Emperor Alexander the Second of Russia. The bloodiest pogroms occurred during the Russian Revolution of 1905. The first pogrom took place in April 1903 in Chisinau (nowadays in the Republic of Moldova), in the next three years taking place no less than 650 pogroms (Lambroza, 1987, p. 287).

Therefore, both Israeli society and the needs of a future state revolved around the migration phenomenon. Although Jews and Arabs continued to live in Palestine over the 2000 years gap, the idea of the State of Israel began to take shape within the six great waves of immigrants.

The first group which arrived in Israel in the late nineteenth century was predominately made up of Jews from the Eastern European bloc. This was succeeded by a large Russian movement, which arrived in Israel after the Russian Revolution of 1905 and the other pogroms in Russia. Those certain immigrants have been the driving force behind the establishment of kibbutzim (Kibbutz- a type of communal settlement that can be found only in Israel. All the members in the community work together traditionally in agriculture and all wealth is held in common and the profits are reinvested in the settlement), or communal settlers, as they had a special interest in developing a collective and collaborative community (USA University College Directory, Israel – History Background, n.d.).

2. ISRAELI EDUCATIONAL SYSTEM

Nowadays, in Israel, there are four educational levels, starting with pre-primary or from nursery school through primary and secondary education to various levels of higher education. With a transformation of the Compulsory Education Law in 1984, the introduction of two years of preschool was officially implemented. Additionally, primary education is both free and required (grades 1-8). Grades 9 and 10 have also been free and required since about the 1960s. Secondary education, which lasts through grade 12, is free but not required (USA University College Directory, Israel – Educational System Overview, n.d.).

In Israel, there seem to be three different kinds of high schools: academic, career-related technical, and comprehensive. Academic high schools begin preparing high school graduates and lead through matriculation certificates. Vocational technical high schools educate people about technical as well as practical career choices in engineering or other sectors. There are numerous types of training institutions at the postsecondary level that provide instruction for careers in healthcare, teaching elementary school, and other technical fields. Seven institutions offer bachelor's, master's, and doctoral degrees. Students must pass the "bagrut", or nationwide admissions exam, to be admitted to a university (USA University College Directory, Israel – Educational System Overview, n.d.).

The Ministry of Education and Culture is in charge of centralizing and standardizing the curriculum across the entire Israeli educational system. All levels of education, which include higher education, are under the Ministry's supervision; the Council for Higher Education is in charge of this sector. The education system goes further than the conventional distinctions between public, private, and state-religious schools to address the diversity of the population through a variety of methods (USA University College Directory, Israel – Educational System Overview, n.d.).

The preschool educational program evolved from the traditional Jewish educational program (Heder), which was a type of early childhood education popular among Jews in the Middle Ages. Heder

meant that boys aged 3 to 13 would study Hebrew and receive religious instruction from a particular teacher. Israeli educators had started to create elementary school and preschool curricula in line with contemporary theories of early childhood growth by the turn of the 20th century. Such schemes involve basic educational reading and writing preparatory work, social skills development, and study of the Hebrew language and culture. Both preschool and elementary schools aim to promote children's development and national unity by providing all teenagers with equal access to quality education (USA University College Directory, Israel – Preprimary Primary Education, n.d.).

There have originally been many clashing primary education methods before Israel became a state. The main distinction between these methods was how much time was spent on religious studies compared to secular topics. By the end of World War I, modern Hebrew had also been widely used in schools as its primary language of instruction. Private religious schools and state or state-religious schools were established by the State Education Law of 1953 (USA University College Directory, Israel – Preprimary Primary Education, n.d.).

The diversified community of Israel and its substantial immigrant populations are taken seriously in primary schools. The spotlight of teaching in the primary school system focuses on the dual objectives of fairness and justice as well as integration into Israeli society. Due to the inability to meet these objectives, the educational system needed to undergo significant changes. The School Reform Act introduced modernization in 1968. The role of parents in the education system has evolved, and some parents still want more control over which school their children attend. Additionally, parents demanded control over the course content and curricular enrichment in both the creative and academic fields (USA University College Directory, Israel – Preprimary Primary Education, n.d.).

The Ministry of Education and Culture determines the basic school curricula. It covers the standard curriculums taught in schools, such as scientific knowledge, basic arithmetic, geography, historical background, and so forth. Teenagers also learn about the Bible and the Talmud (Jewish tradition) in all colleges, though the state religious schools give more attention to such topics than some public schools do. Hebrew vocabulary and literature are learned by children in language courses since they may not be the natal tongue of some immigrant groups. Starting through grade 5 or grade 6, students are expected to study English as their first-second language; however, in some schools, French is officially compulsory (USA University College Directory, Israel – Preprimary Primary Education, n. d.).

An interesting strategy used within the educational system in Israel is to keep students in the same group. Young people do not move to other groups from one year to the next, they remain in the same class for the entire duration of the educational cycle. There is a lot of emphasis on developing friendly relationships between the members of the group, and at the same time trying to keep an entire class united, without making differences between more talented students and those with weaker grades.

We have called this practice a strategy, however, because there is also an aspect of preparing young people for the compulsory military service that is still present in Israel. So, this method comes to the aid of children they often get to know their colleagues in the army for several years. They are trying to form a community, through so-called "small groups" of dozens of young people. In this way the whole system will work better, will be more efficient, and the soldiers will have more confidence in each other.

3. ISRAEL'S EDUCATIONAL SYSTEM REFORMS

Secondary education was paid for by tuition even before Israel's autonomy and throughout the early days of its existence as a nation. It wasn't required. Just after modernization with reforms in 1968, there was no tuition and all students had to attend classes till 10th grade. The failed effort of the schools to provide full equality, particularly for underprivileged students, and the perceived limited capacity of the schools to help in the integration of different immigrant groups into Israeli society led to such shifts (USA University College Directory, Israel – Secondary Education, n.d.).

Several native languages were carried by the numerous waves of immigrants. They founded or attended schools that spoke the local immigrant group's native tongue, such as German, Russian, etc. A large number of immigrants spoke Yiddish, which was also used in a few educational establishments. There had been a Hebrew Teachers' Association by 1903, which supported educators throughout the region who wished to keep using Hebrew as the dialect of school instruction. Also, an important aspect was that Zionists began using only Hebrew in their school. (USA University College Directory, Israel – Secondary Education, n.d.).

The establishment of the very first accredited university, the Technion, in Haifa, triggered a linguistic conflict. Leading up to its official establishment, the Technion had been funded by charitable contributions from Russian and German channels, as well as being supervised by German supervisors who desired to be using German as the teaching language (USA University College Directory, Israel – Secondary Education, n.d.). The State of Israel is a complex case in which we can analyze the various aspects of a multicultural society. This society also has an impact on the educational system.

The chief information officer Dr. Ofer Rimon from the Ministry of Education in Israel said that they were looking for a platform to “centralize and automate management”. The Ministry needed a centralized database with a “uniform enforcement of information security procedures.” Last but not least, they needed “an effective self-service function, where users can update their accounts.” (Ministry of Education Israel, Case Study, 2021).

This system will facilitate the access of both students and teachers to daily educational activities. This platform shows the openness of the Ministry of Education towards digitalization, towards an innovative field in education.

The Ministry makes also significant investments in implementing a digital educational system, in addition to the introduction of online books, learning management systems, e-learning climates, notebooks access to all students, and also the installation of internet services and infrastructure in schools, the need for an organized identity management platform to achieve prompt but also prevent unauthorized access has increased (Ministry of Education Israel, Case Study, 2021). One of the highlights of this software program was that it provided a fully automated platform for more than two million users. The Ministry relies mostly on cloud-based applications and other management solutions.

The pre-state Jewish community have already established and sustained an operational educational system by the time the State of Israel was established (1948), using Hebrew as the teaching language. Hebrew had indeed been brought back to life for everyday discourse just at the end of the nineteenth century. (My Jewish Learning, n.d.)

The newly founded state had to impose several reforms in different development phases. The newly formed Ministry of Education dealt with a shortage of highly trained educators, uneducated and poor parents, and a severe economic crisis, also a poverty nation that continued to struggle in the first ten years. All these facts added to a community that was constantly increasing. (Sprinzak et al, 2004, p. 63). Moreover, in the Jewish tradition, there is a high emphasis on the quality of the educational system. This is why Jewish communities were among the first to implement mandatory courses for young people (Axinte, 2022, p. 230).

The educational system in Israel can also be seen from the perspective of a system that wants the cohesion of a society with many points of view. Education can help integrate multiple groups into the same community, giving freedom to each vision. Israel's education system wants to form a society without segregation in schools, racial differences, and the elimination of differential treatment from society (Axinte, 2022, p. 235). The school has the role of developing culture and civil society, but it can also have an impact on the economy and the development of other state institutions.

4. EDUCATION MANAGEMENT IN THE CONTEMPORARY WORLD

Education management along with educational administration and educational leadership is one of the main perspectives in this field. Its overarching goal of educational management would be to successfully and cost-effectively build and keep surroundings throughout academic institutions that foster, encourage, and preserve effective education and learning, however the specific methods used to accomplish these key goals can vary greatly based upon its educational system or tier and throughout academic societies (Lynch et al, 2020). The government is always in charge of creating, organizing, and setting up educational systems. Human resource management, campus life, financial support, evaluation, and housing for people with disabilities are among the sectors available to experts in education management. These roles concentrate on different facets of education and work to enhance and optimize the educational system (Helmy, 2022).

5. CONCLUSION

In conclusion, the management of the educational system in Israel has been very focused on managing the migration phenomenon and adapting the educational process to each different group of people. The Israeli state had to invest in an educational system that can eliminate inequalities in society, and create a solid community that incorporates more ideologies. Education management involves a national strategy that eventually comes to focus on the individual.

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Marketing, Sales and Supply Chain Management: A Case Study in Sports Marketing Human Resources Costing

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Operations Management;
Effort Based Costing



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Abstract: A systematic literature survey on sales and marketing operations is presented with an emphasis on supply chain management. Articles included in the survey are categorized into four main categories identified namely: Supply Chain Management, Sales and Operations Planning, Artificial Intelligence and Big Data Analytics. The theory of Sports Marketing is presented as well as an effort-based costing case study of a team of Sports Marketing professionals working in marketing, sales and supply chain management. The costing case study approach provides activity costs calculations as well as the required Full-Time Equivalents per activity. Based on these calculations further performance metrics per activity are calculated.

1. INTRODUCTION

Money saving and efficiency improvement are considered constant goals for most companies globally. A very useful and innovative tool, to succeed in all business areas, is Sales and Operations Planning (S&OP). As a result of the new challenges faced by companies/organizations, to achieve the aforementioned goals, there is a growing interest from academics/researchers in the field of sales and marketing.

For example, the effectiveness of applying Artificial Intelligence in supply chain management (Dogru & Keskin, 2020; Toorajipour et al., 2021), the use of a structural equation model (Goh & Eldridge, 2019) or the adoption of the circular economy (CE) business models for operations management (Jabbour et al., 2019), are just some of the frameworks presented in the literature survey above.

Facing this dynamic, the sports industry could not remain unaffected requiring innovative and integrated sales and programming activities to implement new marketing strategies (Niessen & Bocken, 2021). Finally, in the context of the present research, a case study was contacted presenting the example of human resource costing of a core team consisting of six sports marketing employees.

The costing approach used was effort-based costing (Glykas, 2011; Sachini et al., 2022) in which workers' costs allocated per activity are calculated based on the percentage each employee devotes per activity.

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2. SUPPLY CHAIN MANAGEMENT (SCM)

Sales and Operations Planning S&OP is a process that mainly ensures a balance between demand and supply and links supply chain planning with the connected and involved functional departments. The main benefits/advantages of harmonizing all stages in the supply chain and evaluating financial information is a better view of future capacity or sales problems, better customer service and faster changes in production rates. Overall, there is an improvement in fulfilling the customer's wishes. To succeed in company objectives and coordinate production with forecasted demand, the application of good forecasts and a variety of simulations are considered very important.

Jabbour et al. (2019) conducted a systematic literature review for the identification and examination of the following key areas: (1) the new demands facing operations management decision-making related to changes in capabilities, work processes, relationships and technologies within and between organizations (2) the specific changes that operations management decision making must make in order to support CE business models (based on the ReSOLVE framework) and (3) guidelines to help planners, businesses, and supply chain managers develop the necessary skills. Specifically, the research attempts to examine and conceptualize the implications of adopting circular economy (CE) business models on operations management (OM) decision-making processes, in the areas of product design, logistics production planning and control chain.

Huang et al. (2020) also provided an extensive literature survey (evaluating 152 peer-reviewed journal articles that meet the inclusion criteria) to identify research focus and gaps in the value of social media in OSCM, supported by an appropriate conceptual framework. One of the survey's findings highlights the lack of control/ governance in the way companies use social media data for OSCM activities.

In contrast, Talwar et al. (2021) limited their scientific research to the investigation of the dimensions, advantages, areas, possibilities and obstacles of Big DATA implementation in OSCM. The study concluded with the development of a conceptual framework, the Dimensions-Avenues-Benefits (DAB) model for the adoption of BDA.

Furthermore, Goh & Eldridge (2019) revealed evidence of the negative relationship between S&OP Process/Planning and Supply Chain Performance. The study has focused on elaborating and extending existing knowledge and on the links between S&OP implementation and Supply Chain Performance. Furthermore, a structural equation model was developed in which six S&OP coordination mechanisms hypothetically contribute to improved supply chain performance. The model was tested using a global survey of 568 experienced S&OP professionals.

Additionally, Yu & Huo (2018) examined the effects of relational capital on supply chain quality integration (SCQI) and operational performance, from the holistic perspective of the entire supply chain. They conclude that building strong relationships with supply chain partners is the key-factor for companies to win tenders.

Dogru & Keskin (2020) focused on the analysis of the recent applications of artificial intelligence in operations management (OM) and supply chain management (SCM). They highlight the main challenges and opportunities for the use of artificial intelligence in these industries. Finally, current research topics with significant value potential in these areas are listed.

More recent research (Toorajipour et al., 2021) attempts to determine the contribution of artificial intelligence (AI) to supply chain management (SCM). Research outcomes indicate that the most widespread artificial intelligence techniques are 1st ANN, 2nd FL and 3rd ABS/MAS. However, they aim to identify current and potentially artificial intelligence techniques that can improve both the study and practice of SCM.

Helo & Hao (2021) also conducted a review of the concept of AI and SCM focused on timely and critical analysis of AI-driven supply chain research and applications. They specifically emphasize that the SC should be digitized and increasingly dependent on technology in the form of IoT and sensors throughout the SC.

Matos et al. (2020) point out the contingencies, trade-offs and tensions of sustainable operations and supply chain management (OSCM), emphasizing that the above should be considered inevitable.

Stolze et. al (2018) argue that focusing on the decision-making and behaviors of front-line individuals could be a basis for understanding cross-functional integration and firm-level outcomes. Supply chain integration elaboration through network theory could provide useful information about the driving forces behind CPG marketing execution in the retail supply chain. Finally, the present study makes use of social networks, through inductive qualitative methods based on grounded theory and ethnography.

LeMay et al. (2017) compile current definitions of supply chain management in practical and analytical use, develop standards for evaluating definitions and apply them to the most readily available definitions of the term. Finally, they list suggested definitions for consideration.

Furthermore, Min et al. (2019) point out the key market and technological changes that have occurred in SCM. They believe that research with an emphasis on theorizing the very nature, market, and technological changes will lead to the transformation of SCM. Also, this article highlights the key markets and technological changes that have occurred in SCM.

In addition, the relationship between GSCM pressures, practices and performance is emphasized under the moderating effect of quick response (QR) technology (for Chinese firms) in Li et al. (2020) theoretical approach. Institutional Theory, Resource-Based Theory (RBV) and GSCM literature are combined along with the use of statistical analysis of collected data and case studies from companies in China. The outcomes revealed that the effect of GSCM practices on negative financial performance is smaller than on positive financial performance.

Nemati et al. (2017) elaborated on the investigation of the benefits of S&OP through (FI-S&OP), (PI-S&OP) and (DP) models (for a multi-site manufacturing company in Iran) and demonstrate a slight superiority of FI-S&OP over the PI-S&OP model and a strong dominance over the DP model.

Feng and Shanthikumar (2018) focus on two aspects of supply chain management, namely, demand management, manufacturing and the way that Big Data can change the above. They summarize some relevant concepts that have emerged with Big Data and present several prototype models to show how these concepts can lead to a rethinking of this research. They highlight that using Big Data is not just about extending our models using additional functions but it can also provide an understanding of general contexts without having to postulate the real data as inputs.

Tsay et al. (2018) examined Production and Operations Management (POM) concerning outsourcing in the supply chain context. Ardito et al. (2018) presented innovative efforts on the development of digital technologies to manage the interface between supply chain management, marketing processes and the role they play in sustaining supply chain marketing (SCM-M). They present patent analysis and real examples and highlighted the role these solutions play in acquiring, storing and processing information for the integration of SCM-M.

3. SALES AND OPERATIONS PLANNING

Nowadays more and more industries adopt Sales and Operations Planning aiming to line up everyday operations with corporate strategy. Although the process was primarily applied on the supply chain to balance supply and demand, it has evolved into holistic business management and decision-making models. In its advanced form, Sales and Operations Planning involves, in addition to supply chain and production, sales, marketing and management. These types of advanced organization-wide processes are often cited by successful companies as their "key to success" in increasing their performance and reducing their operating costs.

According to Wery et al. (2018), an optimization simulation-based framework is proposed for new product demand management. A log analysis simulator is used in conjunction with a tactical planning model to perform sales and operations planning. The plan provides information to the decision maker about which orders for specialized products to accept, what to produce and when, as well as the equipment arrangements to use and the raw material to purchase/consume in each period. An industry-inspired case study shows how the framework can lead to significant benefits. While it is concluded that this framework allows for finding the best combination of scenarios.

Danese et al. (2017) analyzed the execution of the transition between maturity stages in S&OP, by comparing three case studies of S&OP transitions with different initiation and destination maturity stages. The study concluded that moving to a more advanced stage of S&OP maturity requires a balanced execution of all key dimensions.

In addition, Darmawan et al. (2018) present a framework for developing a decision support model to acquire a sales and operations plan (S&OP) that integrates production planning and price promotion decisions. They also aim to identify gaps in the value of social media in OSCM, supported by an appropriate conceptual framework. Research outcomes point out that the resulting qualitative insights can be generalized to other problems with a different set of parameters.

Pereira et al. (2020) provided a review of existing decision-making models, e.g. optimization tools that support S&OP in order to present and characterize S&OP from a modeling perspective. A holistic framework encompassing the decisions involved in this planning activity is presented. An interesting finding of the survey, in which the papers were classified according to the modeling approaches used by previous researchers, was that there are no synthesis models that characterize the overall S&OP problem.

Noroozi & Wikner's (2017) review of sales and operations planning (S&OP) in process industries (PIs), was aiming to investigate the current state of S&OP in such industries compared to the discrete manufacturing sector and to identify the specific characteristics of PIs that can be influential at the S&OP level. They conclude that there is a need for conceptual models with an emphasis on specific characteristics of PIs.

Additionally, a maturity framework for sustainability integration is proposed, guided by the evolution of sustainable operations capabilities based on Machado et al. (2017) theoretical approach. Furthermore, prompting a company to develop standards of operations excellence with an emphasis on long-term profits, innovation and continuous improvement, the five maturity levels in sustainable operations management are emphasized.

According to Kristensen and Jonsson (2018) S&OP response variables are a product of S&OP related variables in addition to being dependent on S&OP maturity. Specifically, the study describes-categorizes the ways that current literature contributes to sales-operations planning (S&OP) research, and the ways that environmental variables influence planning S&OP and frames future areas for context-based S&OP research. Studies for review were retrieved through a keyword search of five relevant databases, manual searches of relevant journals and collection of references in relevant papers. In total, 571 papers published between 2000 and 2017 were evaluated and 68 papers were included in the review.

In addition, Bijmolt et al. (2021) developed a framework with the following key decision areas: (i) assortment and inventory, (ii) distribution and delivery, and (iii) returns. For each of the areas, the key decisions that affect or concern both the customer journey and the product flow are first identified. Then, for each decision, the marketing and operational goals and the tensions that arise when those goals are not perfectly aligned are described. Opportunities to alleviate these tensions are also discussed, and possible directions for future research aimed at addressing these tensions and opportunities are presented. While highlighting how an integrated marketing-business perspective can be formulated to address these interdependencies.

Ambrose et al. (2018) attempt to capture the applications of social identity theory to the study of sales and operations planning to show whether fostering superior identity can aid integration efforts in this unique cross-functional team environment. The importance of senior team identity in achieving sales performance and operations planning was emphasized during the research process.

Also, Groza et al. (2021) argue that the sales manager's intellectual stimulation contributes to the promotion of organizational innovation and, in turn, sales growth. They conclude that the degree to which the sales department is embedded in the firm strengthens this positive relationship. Furthermore, the results point out that a sales manager's intellectual stimulation can lead to organizational innovation.

In addition to the above, Kreuter et al. (2021) conducted a review of the empirical and theoretical perspectives on sales and operations planning (S&OP). They identify three main streams of research: S&OP and performance, S&OP implementation, and integration of S&OP plans. The research also included empirical S&OP research based more on the theory of two effects: applying general theories from other fields and developing internal theories through middle-range theorists. Although the review was limited to empirical studies rather than conceptual work, research results can support the development of solutions to improve the effectiveness of S&OP and real-time evidence-based decisions.

Also, Wang et al. (2021) study the interface between operations and finance in risk management. Through methodologies, they systematically present the progress of research from the beginning to its recent findings (through analytical, conceptual or empirical approaches). Finally,

to process any new information, they trace in detail the historical development in recent contributions and thus identify possible inconsistencies in the literature as future research directions.

According to [Stentoft et al. \(2020\)](#), the lack of implementation skills does not affect the relevance of S&OP. The study aimed to understand the relationship between the reasons for not using Sales and Operations Planning (S&OP), the perceived relevance of S&OP and business performance.

Finally, a literature review of sales and operations planning is presented by [Nabil et al. \(2018\)](#) as well as various research and models developed. The outcomes of the survey emphasize the main purpose of research involving operational issues, tactical and strategic in a context subject to different constraints.

4. ARTIFICIAL INTELLIGENCE (AI)

Artificial intelligence or machine learning is an approach to using massive data sets to train machines to perform tasks in semi-supervised ways. This applies to the entire manufacturing life-cycle, from problem identification to communication and then problem resolution. Automation is essential to streamline repetitive tasks such as scheduling and rescheduling, planning, and data tracking. Artificial intelligence should touch all aspects of the manufacturing value chain, from the shop floor to management systems and resource development systems.

[Dogru & Keskin \(2020\)](#) present the recent applications of artificial intelligence in operations management (OM) and supply chain management (SCM) highlighting the main challenges and opportunities for the use of artificial intelligence in the industries above. Specifically, innovations in healthcare, manufacturing and retail activities are considered, as collectively these three sectors account for the majority of AI innovations in business as well as growing problem areas. Finally, current research topics with significant value potential in these areas are listed.

Furthermore, [Toorajipour et al. \(2021\)](#) seek to determine the contribution of artificial intelligence (AI) to supply chain management (SCM). They aim to identify current and potentially artificial intelligence techniques that can improve both the study and practice of SCM. While they conclude that the most widespread artificial intelligence techniques are 1st ANN, 2nd FL and 3rd ABS/MAS.

Additionally, based on [Helo & Hao's \(2021\)](#) overview of the concept of AI and SCM, an extra focus on timely and critical analysis of AI-driven supply chain research and applications is given. Furthermore, they emphasize the reasons that the SC should be digitized and increasingly dependent on technology in the form of IoT and sensors throughout the SC.

Finally, [Han et. al \(2021\)](#) explores the approaches that artificial intelligence can be used to enable B2B marketing innovation. The study further categorizes the use of AI for B2B marketing innovation into five areas, identifying the main trends in the literature.

5. BIG DATA ANALYTICS (BDA)

Data analytics solutions are significantly important for ensuring efficient business operations and timely logistics and operations. The field of data analytics is applied to bring enhanced intelligence to the corporate decision-making engine. Also, BDA enables managers to understand

their business dynamics, anticipate market changes and manage risks. Companies increasingly depend on data analytics to personalize products and services and scale digital platforms to match buyers with sellers. According to [Talwar et al. \(2021\)](#), SLR is limited to investigating the dimensions, benefits, areas, opportunities and barriers of Big DATA implementation in OSCM. As a result of the SLR is the development of a conceptual framework, the Dimensions-Avenues-Benefits (DAB) model for the adoption of BDA.

Even [Schlegel et al. \(2020\)](#) explore how big data analytics capabilities (BDAC) enables the implementation of integrated business planning (IBP) – the advanced form of sales and operations planning (S&OP) – offsetting increasing information processing demands. The research model is based on organizational information processing theory (OIPT). They conclude that for the implementation of IBP in an organization related to effective and efficient decision-making, BDAC is necessary.

In addition, [Roden et al. \(2017\)](#) explore how Big Data can be used in different sectors and examine how it encourages change in the basic operating models of organizations and point out that most existing research has so far focused on incremental improvements in functionality.

Finally, [Feng & Shanthikumar \(2018\)](#) focus on two aspects of supply chain management, namely, demand management, manufacturing and how Big Data can change the above. They summarize some relevant concepts that have emerged with Big Data and present several prototype models to show how these concepts can lead to a rethinking of this research. While they point out that using Big Data is not just about extending our models with additional functions.

Table 1. Literature Survey of Marketing, Sales and Supply Chain Management

Reference	Summary	Approach Methodology	Products-Services-Subjects	Cite Score
Wery et al. (2018)	It proposes an optimization simulation-based framework for dealing with these kinds of problems.	A log analysis simulator is used in conjunction with a tactical planning model to perform sales and operations planning.	Engineering, Computer science	16.9
Jabbour et al. (2019)	Conceptualizes the implications of circular economy (CE) business models on operations management (OM)	Literature review	Business, Management, Accounting, Decision Sciences, Engineering, Environmental sciences	15.8
Danese et al. (2017)	This article focuses on the so-called S&OP "maturity models", which describe the successive stages in the evolution of the S&OP process according to a precise set of dimensions.	Case studies of S&OP transitions with different initiation and destination maturity stages have been compared.	Business, Management and Accounting, Decision Sciences, Engineering	14.6
Agus Darmawan, et. al. (2018)	Presents a new modeling framework for the development of a sales and operations plan that integrates promotional and production planning decisions.	Incorporates a market appearance-brand choice-purchase quantity model and a mixed integer linear programming model to develop an optimal promotion-production plan.	Business, Management and Accounting, Decision Sciences, Engineering	14.6
Huang et al. (2020)	It identifies gaps in the value of social media in OSCM, within a conceptual framework.	A systematic review of English language articles was conducted following the procedures outlined by Denyer and Tranfield (2009).	Business, Management, Accounting, Decision Sciences, Engineering	14.6
Talwar et. al (2021)	The present study conducted an SLR to synthesize the existing literature on Big Data implementation in OSCM.	Literature Review (SLR)	Business, Management and Accounting, Decision Sciences, Engineering	14.6

Reference	Summary	Approach Methodology	Products-Services-Subjects	Cite Score
Pereira et. al (2020)	This paper reviews existing decision-making models, e.g. optimization tools that support S&OP.	Literature review based on the methodology proposed by Thome et al. (2016).	Business, Management, Accounting, Economics, Econometrics, Finance, Decision Sciences, Engineering	14.3
Goh & Eldridge (2019)	This paper investigates the effect of S&OP on supply chain	Structural equation model	Business, Management, Accounting, Economics, Econometrics, Finance, Decision Sciences, Engineering	14.3
Noroozi & Wikner (2017)	This paper provides a systematic literature review of sales and operations planning (S&OP) in process industries (PIs).	Literature review	Business, Management, Accounting, Decision Sciences, Engineering, Finance	14.3
Machado et al. (2017)	This paper proposes a maturity framework for sustainability integration, driven by the evolution of sustainable operations capabilities.	Literature review and results from two-panel studies conducted with academics and practitioners.	Business, Management and Accounting, Decision Sciences, Engineering, Finance	14.3
Yu & Huo (2018)	This paper aims to examine the effects of relational capital on supply chain quality integration (SCQI) and operational performance.	Applied structural equation modeling with LISREL to test a conceptual model based on data collected from 308 companies in China.	Business, Management and Accounting	13.4
Dogru & Keskin (2020)	It examines recent applications of artificial intelligence in operations management (OM) and supply chain management (SCM).	Case Study	Business, Management and Accounting Decision Sciences, Computer Science	13.1
Kristensen & Jonsson (2018)	Categories how the current literature contributes to sales-operations planning (S&OP)	A systematic literature review	Business, Management and Accounting, Social science	11.4
Schlegel et al. (2020)	This study explores how big data analytics capabilities (BDAC) enables the implementation of integrated business planning (IBP).	The research model is based on organizational information processing theory (OIPT) and a case study.	Business, Management, Accounting, Social science	11.4
Bijmolt et. al. (2021)	A framework is developed with the three key decision areas: (i) assortment and inventory, (ii) distribution and delivery, and (iii) returns.	Key decisions affecting both the customer and the product flow are identified. For each decision, marketing and operational objectives are described as well as the tensions that arise when these objectives are not perfectly aligned.	Business, Management, Accounting, Marketing	11.2
Ambrose et al. (2018)	Applies social identity theory to the study of sales and operations planning.	Responses from key informants representing middle management from the sales and operations functional areas were used.	Marketing	11.2
Toorajipour et al. (2021)	This paper seeks to identify the contribution of artificial intelligence (AI) to supply chain management (SCM).	Systematic review of existing literature	Business, Management and Accounting	11.2
Petri & Yuqiuge (2021)	Provides an overview of the concept of AI and SCM and focuses on timely and critical research analysis of AI-driven supply chain applications.	Case study	Decision Sciences, Engineering, Business, Management, Accounting, Computer Science	11.1
Matos et al. (2020)	Explores (un)expected outcomes, trade-offs and tensions in sustainable OSCM	Literature review	Business, Management, Accounting, Decision Sciences	11.1

Reference	Summary	Approach Methodology	Products-Services-Subjects	Cite Score
Roden et al. (2017)	Examines how Big Data can be applied in different areas in leading organizations and the ways it changes the basic operating models of organizations.	Case studies and implementation of a test framework.	Business, Management, Accounting, Decision Sciences, Engineering	11.1
Groza et al. (2021)	Examines how the intellectual stimulation of the sales manager helps to promote organizational innovation and, in turn, increase sales.	An online database of industrial enterprises from the United States was used for data collection. Random sample from 1000 B2B.	Business, Management, Accounting, Marketing	10.4
Martinez-Lopez et al. (2020)	Focuses on the IMM journal, with an extensive bibliometric analysis of the IMM from its inception in 1971 to 2017.	Bibliometric analysis	Business, Management, Accounting	10.4
Stolze et al. (2018)	This research elaborates on supply chain integration through network theory.	Applies social network analysis, and inductive qualitative methods based on grounded theory and ethnography.	Financial Business, Management and Accounting	10.2
LeMay et al. (2017)	Brings together definitions of supply chain management in practical and analytical use, develops standards for evaluating definitions, and applies them to the most readily available definitions of the term.	Collection of supply chain management definitions from journals, textbooks, universities, industry associations, and the Internet.	Business, Management and Accounting Social science	10.1
Min et al. (2019)	This article highlights the key markets and technological changes that have occurred in SCM.	It follows the theory proposed in the article entitled "Defining Supply Chain Management" published in 2001 in the Journal of Business Logistics.	Business, Management and Accounting, Decision Sciences	10
Li et al. (2020)	The study addresses the relationship between GSCM pressures, practices and performance under the moderating effect of quick response (QR) technology.	It combines Institutional Theory, Resource-Based Theory (RBV) and the GSCM literature. Uses statistical analysis of collected data and case studies from companies in China.	Business, Management, Accounting, Decision Sciences, Engineering	8.8
Kreuter et al. (2021)	Assesses empirical and theoretical perspectives on sales and operations planning (S&OP).	Systematic literature review. The work applies an SLR following the step-by-step approach proposed by Thomé et al. (2016).	Business, Management, Accounting, General Business, Management, Accounting	8.0
Nemati et al. (2017)	This study explores the benefits of S&OP.	Mathematical approach using 3 mixed integer programming models in a real dairy industry in Iran	Chemical engineering Computer Science	7.6
Han et al. (2021)	This study explores the approaches that artificial intelligence can be used to enable B2B marketing innovation.	Applying a bibliometric research method.	Business, Management, Accounting, Marketing, Strategy, Management Information Systems, Engineering, Industrial Engineering, Computer Science, IT Applications	7.3
Feng & Shanthikumar (2018)	This essay focuses on two aspects of supply chain management. Specifically, demand management and manufacturing.	It summarizes some relevant concepts that have emerged with Big Data and presents several prototype models to show how these concepts can lead to a rethinking of this research.	Decision Sciences, Engineering Business, Management and Accounting	6.6

Reference	Summary	Approach Methodology	Products-Services-Subjects	Cite Score
Wang et al. (2021)	Provides a comprehensive research overview and directions for future research on the interface between operations and finance in risk management.	Combination of methodologies	Business, Management, Accounting, Decision Sciences, Engineering	6.6
Tsay et al. (2018)	This article reviews cutting-edge academic research in Production and Operations Management (POM) on outsourcing in supply chain contexts.	Review of publications from the POM community from 2000 to 2016. Divides research into empirical/conceptual.	Business, Management and Accounting Decision Sciences, Engineering	6.6
Ardito et al. (2018)	Presents innovative efforts aiming at developing digital technologies to manage the interface between supply chain management and marketing processes and the role they play in sustainable supply chain marketing. (SCM-M)	The paper uses patent analysis and real examples.	Business, Management, Accounting	6.2
Stentoft et al. (2020)	Advances the understanding of the reasons for not using Sales and Operations Planning (S&OP) as well as the relevance of S&OP to business performance.	Questionnaire research	Business, Management, Accounting, Decision Sciences	4.3
Nabil et al. (2018)	Provides a literature review of sales and operations planning, as well as research efforts and models. The research focused on operational, tactical and strategic issues subject to different constraints.	Research is done with a literature review related to (S&OP) and the processes that link the strategic objectives of the business with the production plan.	Engineering	1.7

Source: Own research

6. SPORTS MARKETING

Sports Marketing is considered one of the most profitable industries worldwide due to the enormous amount of money that has been invested. Sports companies seek to recruit human resources capable of increasing customer value and concentrate on employees who have a significant influence in the sports industry to undertake marketing expert positions.

Sports Marketing could be defined as the application and extension of marketing theories, methodologies, tools and techniques to the development of marketing plans for sports products, events (professional/amateur), or services. Sports marketing aims to provide potential partners, clients and customers with a multi-aspect sports experience (Fetchko et al., 2018).

Smith and Stewart (2015) have proposed two categories in sports marketing, namely: the “Marketing in Sports” and the “Marketing with Sport” categories. The two categories are distinguished according to the way sports organizations promote their offering of sports products or services in the marketplace as well as their communication techniques. A representative example of the “Marketing with Sports” category could be the sponsorship of a team or an individual athlete. The sponsorship aims to enhance product visibility and increase sales in the main audience focusing on large-scale well known events (Roche, 2006; Bruhn & Rohlmann, 2022).

Sports Marketing can affect in a very efficient way some main areas related to Sports and the consumer community. It can contribute to increasing/formulating customer value. It also enhances,

the elevation and preservation of customer social connections (relationship marketing) as well as the interaction that sports companies/organizations have with society and authorities.

Mahajan (2020) points out the importance of *customer value*. It is also called value per money which is related to how a customer perceives the cost of the service or product relative to the benefits or the level of customer satisfaction. The cost of customer value is referring to expenses associated with the product or service use like the effort devoted or the amount spent on energy or petrol to reach or obtain the use of the service or product.

Berry (1995) refers to *relationship marketing* as an interactive process of making, preserving and reinforcing long-lasting beneficial relationships with individuals and partners. Furthermore, there are some crucial external factors (competitiveness, economical progression, social policy, technological trends and cultural main streams) that organizations should consider for proper marketing decision-making related to new product-service, positioning, placing, pricing and promotion (**Fetchko et al., 2018**). Decision-making related to sports marketing leads to effective marketing strategies and implementation plans.

Despite the ongoing economic and environmental crisis, the Sports industry continues to play a leading role in the invigoration of the global economy (**Zang et al., 2017**). This comes as a consequence of the increasing interest in sports and sports sponsorships and the aspiration to promote sports brands in the global market. A growing number of companies producing products and services related to the sports industry seek ways to apply marketing strategies based on the viability, desirability, feasibility and sustainability of their offerings (**Niessen & Bocken, 2021**). Additionally, marketing strategies should be based on and include activities related to social diversity, women empowerment, increased participation in sports and public wellness through sports (**Fetchko et al., 2018; Niessen & Bocken, 2021**).

7. SPORTS MARKETING HUMAN RESOURCES COSTING

According to **Cole et al. (2006)**, the key factor of lasting organizational change and effective process development is directly related to top management commitment. A highly efficient group of employees under the proper supervision and guidance of a manager could lead to succeeding goals and enhancing sports facilities, along with increasing customer value.

As the most valuable asset within an organization, human resources are considered fundamental for individual and collective knowledge management, especially regarding sporting events (**Galbreath, 2005**). Professional sports events are usually planned and managed by a core small group of employees, large numbers of volunteers and people with temporary or flexible contracts (**Chadwick & Beech, 2007**). The management, costing and performance analysis of this core group of employees needs to be estimated and evaluated constantly in order to improve and enhance collective teamwork.

We present human resources costing example of a core team consisting of six sport marketing employees. The costing approach used is effort-based costing (**Glykas, 2011; Sachini et al., 2022**) in which the employee cost allocated per activity is based on the percentage he/she devotes per activity. The total employee effort devoted to activities per employee is 100%.

The total cost the organization spends per employee (salary, pension, insurance, taxes, etc.) is provided by the Human Resources Department. The employee cost per activity is calculated by

the multiplication of the percentage of each activity multiplied by the total employee cost. The result of our real-life case study example is shown in Table 2.

On the left side of the table are the activities as selected by the APQC (apqc.org) reference framework. In the last line, the total cost represents the employee cost.

Table 2. Effort-Based Costing Case Study

Activities	Employee 1		Employee 2		Employee 3		Employee 4		Employee 5		Employee 6	
	%	Cost	%	Cost	%	Cost	%	Cost	%	Cost	%	Cost
3.1.1 Perform customer and market intelligence analysis (10106)	19	4370	20	2200	17	2720	19	5130	18	2160	19	3610
3.1.1.1 Conduct customer and market research (10108)	20	4600	20	2200	18	2880	21	5670	25	3000	16	3040
3.1.1.3 Analyze market and industry trends (10110)	17	3910	17	1870	13	2080	9	2430	14	1680	8	1520
3.1.2 Evaluate and prioritize market opportunities (10107)	16	3680	16	1760	18	2880	18	4860	13	1560	22	4180
3.2 Develop marketing strategy (10102)	8	1840	8	880	9	1440	10	2700	11	1320	7	1330
3.2.4 Analyze and manage channel performance (20006)	20	4600	19	2090	25	4000	23	6210	19	2280	28	5320
TOTALS	100	23000	100	11000	100	16000	100	27000	100	12000	100	19000

The total cost per activity is calculated by adding the costs calculated for each one of the six employees. Similarly, we can calculate the total effort per activity (Activity Cost column). The **Full-Time Equivalents (FTEs)** per activity are calculated by dividing the total effort per activity by the effort of one full-time employee (100%) (FTE column). The **Cost contribution (CC)** column) is calculated by dividing the activity cost by the total cost of all activities. The **Average Salary** per activity is calculated by the division of the Activity Cost by the FTE per activity. The **Concentration index** presents the average percentage of effort of all employees that participate in an activity and is calculated by dividing the FTE of the activity by the total number of employees that participate in that activity. In our example, the total number of employees that participate in the activities is 6.

Table 3. Performance Measures calculation per activity

FTE	Activity Cost	Cost Contribution	CC %	Av. Salary	Conc. Index	CI %	M	HVA	BVA	LVA
1.12	20190.00	0.19	18.69	18026.79	0.19	18.67	Y	Y		
1.20	21390.00	0.20	19.81	17825.00	0.20	20.00	Y	Y		
0.78	13490.00	0.12	12.49	17294.87	0.13	13.00	Y			Y
1.03	18920.00	0.18	17.52	18368.93	0.17	17.17	Y	Y		
0.53	9510.00	0.09	8.81	17943.40	0.09	8.83	Y	Y		
1.34	24500.00	0.23	22.69	18283.58	0.22	22.33	N		Y	
6	108000	1	100.00							

In addition to the “hard” (calculated factors) we also have “soft” subjective performance measures. For example, with **Mission non mission** analysis we assess the contribution of each activity to the achievement of strategic goals (M column with value yes or no). With **Value Added Analysis** we categorize each activity to its relation to customer value. If the activity is directly related to the customer of product or service development or distribution, then is considered as

High Value Adding (HVA column). If the activity is related to an internal customer, then it is considered Business Value Adding (BVA column). If the output of the activity is not considered useful either by an external or internal customer, then the activity is considered as Low Value Adding (LVA column).

During the reorganization, we start with the elimination of cost and effort spent on activities that are low value-adding and non-missionary, and we redistribute all minimized effort to other activities.

8. DISCUSSION AND CONCLUSION

We provided a systematic literature survey on sales and marketing operations management. We classified publications into four main categories: Supply Chain Management, Sales and Operations Planning, Artificial Intelligence and Big Data Analytics. We elaborated on the theory of each category based on the identified publications.

We then presented the theory of Sports Marketing and its significance in sports organizations. Finally, we provided a case study of a team of Sports Marketing professionals working in marketing, sales and supply chain management. We calculated activity costs as well as the required Full-Time Equivalents per activity they perform.

We used the effort-based costing approach for these calculations and extended it with further performance metrics per activity. Some of the most important ones are: the average salary, concentration index, mission-mission analysis, value-added analysis, etc.

Each activity is analyzed and prioritized according to its importance for the achievement of the organizations' mission (mission analysis) and its importance to its customers (value-added analysis). Prioritization leads the analysts to redistribute effort and costs to more missionary and value adding activities whilst minimizing the effort of value-adding and non-missionary activities.

Our application of the effort-based approach to various sports organizations has proved its validity and appropriateness for cost calculations and reorganizations of teams working in both well-established sports organizations as well as the ones that have periodic non-permanent project-based structures and concentrate on sports events.

A main limitation of our research is related to the fact that we have not yet applied effort-based costing to a large-scale team involving volunteers and sponsor-provided personnel. This is, however, the subject matter of our future research efforts.

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The Rise of Storytelling as a Marketing Strategy for “Made in Italy” Products

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Abstract: Storytelling is the process of using fact and narrative to communicate something to the audience. The first approach to storytelling takes place as children, with the dual purpose of imagining a space-time different from reality, and secondly that of establishing contact with one's parents, who are required to commit themselves daily, to transmit values and teachings. Popular myths and legends perform four functions that allow human beings to understand themselves, others, the mysteries of life and the universe that surrounds them (Atkinson, 2002). These functions are:

- the psychological function: it helps the person to define himself more clearly thanks to the possibility of reordering and deciphering experiences;
- the social function: allows the person to understand what he has in common with others and what distinguishes him;
- the cosmological-philosophical function: it supports the person in having a clearer vision of her role in the world,
- the mystical-religious function: it allows the person to feel awe, wonder, humility and gratitude towards the mysteries that surround them.

More and more small and large companies are engaging in a marketing activity called content marketing, considering the idea that storytelling is the key to attracting and retaining customers, especially in culturally far-away markets.

Storytelling marketing is a description where the company combines the company's identity with the company's philosophy to create a product or service activity (Salzer-Morling & Stannegard, 2004).

In fact, with the global financial crisis of 2009, investors reduced their investments in communication, especially the budget allocated to television (-3.1% in 2011). Conversely, the internet grew (+12.3%) (Nielsen, 2012).

But how to communicate a product to a different culture not sharing the same ideas, symbols, actions and dispositions of the company?

This study aims to analyze which strategies have been applied in the storytelling of typically “Made in Italy” food products and representative of the Italian gastronomic heritage towards Asia.

Briefly, the research aims to answer the following questions:

RQ 1: Which strategies have been adopted by small-medium-large enterprises in order to promote Italian products into culturally distant markets?

RQ 2: Which strategies are effective, in order to be considered also for future business?

The research is therefore based on an analysis of the literature on storytelling as a marketing strategy and then goes on to observe some case studies.



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1. INTRODUCTION

Telling a story through emotional involvement is much more powerful than explaining it analytically. Storytelling, therefore, represents an effective communication tool of value for both online and offline promotional campaigns.

In particular, this technique focuses on the company telling its story, expressing its vision of the world and its target market, and finally communicating how it proposes itself to the public.

The paper, therefore, aims to analyze how storytelling can be used in culturally distant markets, through the case study of some Italian companies that have used it in China. In the first part, a review of the literature on storytelling is conducted, analyzing its meaning, purpose and structure. Following this, the Chinese market and its relationship with Italian-made products are highlighted, showing, through study examples, how storytelling has offered communication possibilities in the promotion of Italian products and brands in the agri-food sector.

2 BACKGROUND

2.1. What Is Storytelling?

A story represents an oral or written performance involving two or more people interpreting past or anticipated experiences. Literature has highlighted the existence of several factors as prerequisites of a story; three necessary elements of a story have been identified: chronology, causality, and character development (Stern, 1994).

Human culture and language learning enable people naturally to think and extract meaning from narratives, and the narrative theory can inform the development of the proposition of storytelling behaviors (Woodside, 2010).

A common human experience constitutes a story prototype that has similar characteristics in a group (Loebbert, 2003). Chronology means that a stimulus with a story content (e.g., advertisement) has an internal temporality, defined as a set of events in a specific order, with a beginning, a middle and an end (Bennet & Royle, 2004). Casualty highlights the temporal relationship between events; an initial event, in fact, results in a response by a character, actions are undertaken to achieve goals, and these actions result in an outcome. Finally, character development pertains to viewers/readers being made aware of the psychological state of the protagonist, that is, what he or she is thinking and feeling.

The chronological sequence and central characters are essential in order to label something a story (Deighton et al., 1989). People are exposed to stories throughout their lives from the moment of birth (Van Laer et al., 2014), because stories are informally told all the time. From parents to children, from grandparents to grandchildren, from teachers to students, at bars, around campfires, and so on (Herskovitz & Crystal, 2010).

Storytelling is a fundamental human activity because through it people can better understand their world and organize their experiences to communicate them to others (Cooper et al., 2010). With the advent of the digital age, images and oral expressions are commonly used, which brings forth the reappearance of 'story' and 'storytelling'.

In the field of marketing and communication, stories and narratives are often used as synonyms. Thus storytelling (narrating) is defined as the vivid description of ideas, beliefs, personal experiences and life- lessons through stories or narratives that evoke powerful emotions and insights (Serrat, 2010). Storytelling emphasizes the act of telling a story and the storyteller can deliver a story through media. According to Fisher (1984), storytelling is such a powerful communication tool because human beings are inherently storytellers and symbol makers, that is, we are *homo narrans*. Since ancestral times, human beings create symbols and communicate them through stories, thus organizing their experiences and promoting a communal way of life.

Storytelling became a fundamental marketing tool, consisting of “using a narrative to connect your brand to customers, with a focus on linking what you stand for to the values you share with your customers” (Loyal, 2018). This instrument is essential to marketing for 5 reasons: (1) people naturally think narratively; (2) stories reinforce memorization; (3) stories afford pleasurable experiences; (4) brands and products can appeal to psychological archetypes, thus reaching a strong identification with consumers; and (5) stories afford clarity (Woodside et al., 2008).

In the field of marketing, related research discusses persuasion in narrative advertising. For example, a narrative advertisement is one presented in the form of a story; this presentation has a different effect from other types of advertisements.

2.2. Storytelling Structure

A story can arouse the audience’s emotions. Whether consciously or unconsciously, we often review experiences that have aroused our feelings (McGaugh, 2003). People’s affective response to advertising affects their attitudes towards the advertising and consequently their attitudes toward brands (Batra & Ray, 1986).

This modified model regards a story as a kind of stimulus (figure 1), and the effect of storytelling in marketing is demonstrated as consumers’ purchase decisions. Consumers’ responses to story information constitute the main way to assess the benefits of storytelling in marketing. The link between story and information processing can be viewed through the five steps when consumers receive and process the information.

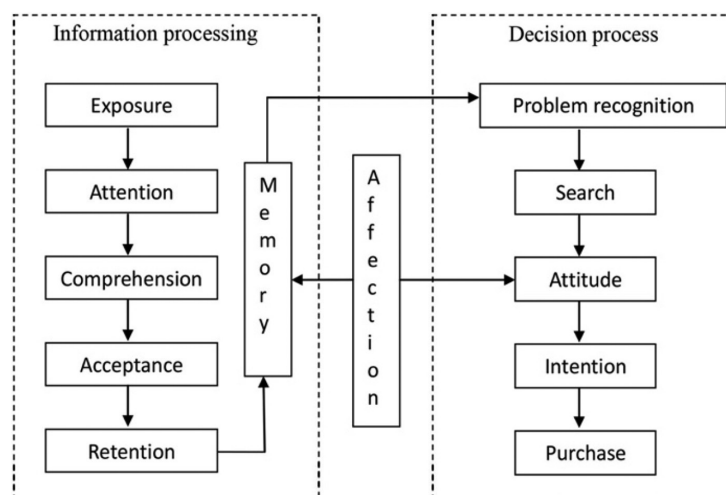


Figure 1. “A modified model of story stimuli on consumer behavior”

Source: Adopted from Engel et al., 1978

In the narrative process, stories about brands or product information can bring pleasure to consumers and lead consumers to relate to one or many story prototypes to achieve a high degree of understanding and acceptance (Holt, 2003). Affection is a specific construct involving emotions, moods, or attitude, among which emotions has the most significant intensity. Emotion is a dynamic process between an organism and the environment (Lazarus, 1982).

The mood has a lower intensity and longer duration. According to Batra and Ray (1986), affective responses are the moods and feelings caused by advertising. In the three phases of communication effects, the affected phase includes the willingness to look for additional information, generate interest in product attributes, and favorably evaluate the product or brand (Guiltnan et al., 1997).

2.3 Advertising Communication

First of all, we need to make a distinction between communicating and knowing how to communicate. Communication is often considered a spontaneous and natural skill; on the contrary, it must be considered as a process permeated with effort and reflection, necessary elements in all types of exchange, especially in intercultural ones. Secondly, we must not underestimate the dependence of the contents of the communicative message on how they are transmitted, on the means that convey them, and on the relationship between the interlocutors (Coppola, 2014).

Four different types of advertising ideologies can be identified:

1. **Referential:** the advertising language performs a representative function, i.e. the simple representation of a reality that already has a meaning (that of the product). Adherents of this type of advertising philosophy, starting with Ogilvy (1989), argue that advertising should simply reflect the reality of the product (often through the mechanism of demonstration). Floch has rightly underlined, however, that referential advertising appears as such because it uses certain discursive strategies which produce an internal referent to the discourse and which aim to present it as true. To this end, the making-seems-true of referential advertising relies on 1) narrative, 2) figurative (and not abstract) and 3) descriptive (and not normative) discourses, or, translated into Ogilvy's language: 1) of before/after articulations, 2) of concrete information or anecdotes and 3) absence of adjectives or slogans (Floch, 1992).
2. **Mythic:** the language performs a constructive function in that the sense is not already present in the reality of the product but is constructed exclusively through the advertising discourse. It often resorts to legends, heroes, symbols, or mythical referents that are already known and structured and strongly associates the product with them. The French advertiser Séguéla (1985), with his philosophy of the star product, is undoubtedly its most significant representative, but Leo Burnett should also be mentioned together with it, who created the historic Marlboro campaign based on the cowboy figure.
3. **Substantial:** it is the negotiation of mythical advertising, considered in this case a form of advertising that uses the product in a specious way. It fights to bring the product to life in advertising, attributing to it, with its virtues, a clear centrality. The creative act is conceived as a purification that allows the public to explore and highlight the profound nature of the product. However, the goal is to obtain an emotion of an aesthetic type, or rather a sudden – and short-lived – inability of the subject to master the sensible world, an inability that shakes him (Floch, 1992). As Floch always maintains, in France Jean Feldman (of the FCA agency) has in recent years been the most representative figure of this advertising philosophy, which has illustrious antecedents in many historic ads created by (Reeves, 1985).

4. **Oblique:** it is the denial of referential advertising, as it argues that the meaning is not already given and uses irony and paradox to activate the cognitive capacity of the user and to stimulate the latter to co-produce the meaning through a strategy of displacement, of distance concerning the discourse concerning the aims of the product; Philippe Michel (of the Clm/Bdbo agency) was, according to Floch, the most representative character in the use of this type of language in France and he too denounces the “falsehood” of realism with his work. (Floch, 1992)

3. DISCUSSION

3.1. Made in Italy in China

After analyzing the development and structure of storytelling, let's see how it can be applied in the promotion of products. Specifically, using a market that is culturally distant from Italian habits and tastes, such as China, we will analyze how Italian products can benefit from promotion through the use of this tool.

Chinese consumers recognize Italian products as a high added value and, in some cases, consider them preferable to other products. The success around the world of items “Made in Italy” is mostly due to the Italian brand’s ability to transfer a certain sense of product quality in concert with values and experiences of beauty, elegance, tradition, luxury, and life quality (Snaiderbaur, 2010).

The Made in Italy industry comprises a galaxy of small and medium-sized enterprises that interpret and communicate the Italian style idea through quality and those who do not care about quality but promote themselves simply by applying the Made in Italy label to the product.

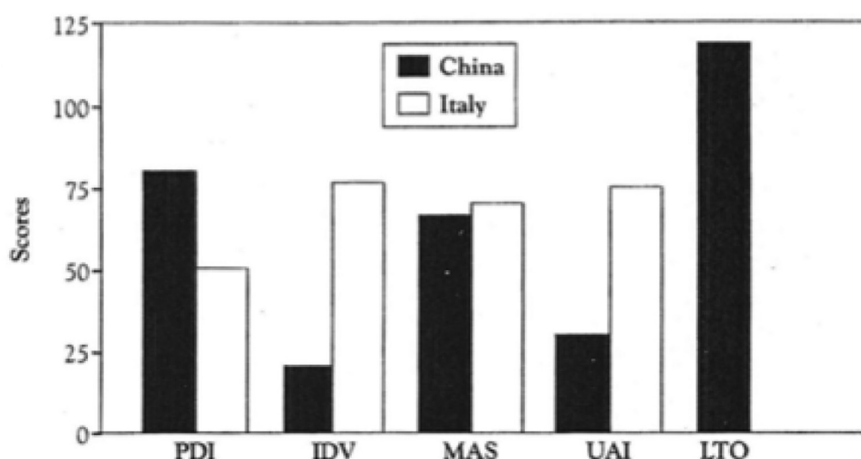
The definition and awareness of the Italian brand’s intangible values are mandatory to penetrate new markets, especially in China, and to maintain a high competitive advantage and higher levels of premium pricing.

The Chinese consumer finds himself or herself immersed in a fast-growing market with the widespread availability of new brands and new products from known and well-established brands. Researchers have found that Chinese consumers have a high intention to buy international brands, although the price of goods is often the decisive factor. In this regard, in 2004 the Leonardo Committee a consortium of private and public institutions, developed a study aimed at understanding the perception of Italian products. From the study emerged a picture in which Italy is considered the country of fashion, in particular concerning leather products (surprising when compared with the same survey conducted in Russia, Sweden and the US, where the gourmet culinary products ranked highest). In this regard, Italian pasta was appreciated almost by all of the participants, while the pizza was considered exotic and expensive.

Despite the interesting data, the differences between the Chinese and Italian cultures are significant; therefore, communication of the brand’s intangible values has to be developed without disregarding a necessary and in-depth knowledge of Chinese culture. Using the differences elaborated by Hofstede (figure 2), significant differences emerge that must be taken into consideration in the creation of advertising messages for the Chinese market.

De Mooij (2005), using the categories of Hofstede culture, has provided a comparative analysis of consumers behavior that offers important information about the differences between China

and Italy; because of Chinese cultural characteristics (high power distance, masculinity and collectivism), Chinese consumers are driven to purchase luxury goods by their need for conformity, social status, and group enhancement, as opposed to Italian consumers (high power distance, masculinity, and individualism).



Note: PDI: Power Distance Index; IDV: Individualism; MAS: Masculinity; UAI: Uncertainty Avoidance Index; LTO: Long-Term Orientation.

Figure 2. – The model of Professor Geert Hofstede

3.2. An Empirical Example of Asian Market Analysis

Understanding the evolutionary dynamics of the Chinese market requires a mix of several kinds of information (market, laws, and even culture) (De Pin, 2019). Chinese food habits have experienced rapid changes in both quantity and quality of diet due to the increased power of consumers and their new lifestyle (Zhou et al., 2014). The Chinese food sector has become, the largest worldwide, with an average annual growth rate near 30% (World Bank, 2013).

In this context, the import of agro-food products explodes and involves an increasingly diversified range of supply. This development affects consumption growth rates, which become very high for meat, dairy products, fish, oil, pasta, confectionery and convenience food. The bigger share is the prerogative of those of first-stage processing (wine, olive oil, cheese) that concentrate 42% of sales (16.1 billion euros).

The incidence of Made in Italy of second-stage processing (pasta, baked goods, coffee, chocolate) exceeds one-fifth of exports, while agricultural Made in Italy is worth over 4.3 billion euros (11% of exports). Primacy goes to wine, with a weight of 13.8% and an increase of 5.6% compared to 2015. The share of fresh fruits is very close at 7% (2.65 billion euros). Other important sectors are pasta (6%), baked goods (4.7%), cheese (4.3%), processed tomatoes (4.1%), cocoa products (4.0%), and cold cuts (3.8%). Among the first sectors, there is also coffee, which abroad sales in 2017 exceeded 1.2 billion euros (+10% compared to 2015). (De Pin, 2019).

Italy occupies the 25th place among countries exporting to China, with a 446 million USD supply in 2017, but features a substantial annual growth rate (about 25%). The agro-food commercial balance highlights a negative value, albeit in contraction, for Italy, which is a net importer of 130.5 million USD. Currently, the main exported product from Italy is wine, followed by chocolate, pasta and bakery products (De Pin, 2019).

3.2. Made in Italy Samples Advertising Analysis

How do Italian companies who decide to export their products to China behave from a marketing point of view?

If it is true that storytelling as a marketing strategy is often more suitable for video advertising and in any case in media format, it is however necessary to analyze which channels have become more effective in terms of transmission, expansion and sharing of the product.

China has one of the largest populations of Internet users in the world, and as such the use of social media, although significantly different from the structures we are used to in the West, is huge to the extent that it projects and converges the greatest attention of domestic and international companies. The presence on channels such as WeChat and Bilibili should be considered essential, as the presence of any street in the application on the map: the presence on social media channels or more generally on the web defines the existence of the business and knowledge through potential consumers.

According to the analysis carried out, it emerged that companies already present in the country and above all with an already defined market tend towards a mythical or substantial language, through which the product, despite being a key element of the campaign, is placed in the background, fully integrated within an extraneous and extemporaneous space-time, with which the ultimate goal is to convey an emotion rather than a definition and description of the product.

It is no coincidence that among the companies analyzed, those that appear to adopt this strategy are, in the range of the food sector observed, those of chocolate.

In Figures 3 and 4 we can observe two posts taken from the official Ferrero accounts of Bilibili and WeChat. In the first case Ferrero with its Rocher product, is capable, thanks to a long-standing market imposition, with strong Chinese appreciation and culturalization, of promoting its product without naming it, without defining it, but with a contextualized description: “Our date, a sweet moment”.

It is therefore the objective of the campaign to evoke and arouse an emotion, contextualizing the use of the product. But this is possible, and will be seen even more clearly in Figure 4 as the Ferrero company has already established itself in China for some time, its products have entered and are part of Chinese culture (see Ferrero Rocher), an advantageous position which allows being able to enter the sphere of affection (Batra & Ray, 1986).

In Figure 4 we see instead the revival of three fairy tales, set inside the Ferrero Castle. With this strategy, the company manages to communicate hard and soft messages to adults and children; with hard specific data that influence the conception of the brand by the consumer, data such as “Built-in 1946, the third most important chocolate castle in the world” (translation), where it is a specific desire to want to convey a message of strengthening to the brand even to the little ones.

Continuing in the campaign, we will interface with the declination of fairy tales such as “The Princess and the Pea”, “The Nutcracker” etc. In the case of the princess and the pea, where the reference to the fairy tale is defined by the fact that the princess is unable to fall asleep because there is something under the mattress that disturbs her, even though there are many layers. And

it is precisely by keeping the layers element that the landlord inserts the Ferrero Rocher element, explaining the composition of each layer.

The same does not do the Venchi company which, on the contrary, specifies, making full use of authenticity and conciseness in how to enjoy the product, bringing it back to typical Italian habits: “A pleasure to take away throughout the year”. Not only is it limited to this, but it also describes how to enjoy the product, advising; “to taste it on an autumn afternoon with the tip of the tongue, with a slow walk through the streets among the autumn colors, etc.”



Figure 3. Ferrero
Source: WeChat, 2022



Figure 4. Ferrero
Source: WeChat, 2022



Figure 5. Venchi
Source: BiliBili, 2022

If we then evaluate other communication strategies, we note for example with the Barilla company (producer of pasta), how the description of the product is set aside in favor of cultural contextualization. Pasta as a food probably already present in Chinese culture does not need a pragmatic description (as contrary to the case, for example, in the posts of the Galbani company, producer of fresh cheeses), but rather a cultural contextualization that can allow, as in the case of Barilla is intended, the consumer to get closer to the type of consumption typical of Italian culture.

(Personal translation) “I’m not a food critic actually, but I know how to recognize a good time for some good food (literary translation with pun not translatable in English). After working, try to leave thoughts out of your head, let yourself be enveloped and pampered by the aromas of the kitchen: in 3 simple steps you can delight yourself with a tasty dish”. In this case, we opted for a transliteration of commercials that we have often seen and still see in Italy, mitigating the message and declining it for the target culture.

It is therefore evident how storytelling has been adopted by food and beverage companies as a marketing strategy, declined and modulated on several levels. It is also evident how directly the correlation between mythical language and the presence of the brand in the country is, where a strong presence of the brand allows the company to focus on evocative and non-explanatory marketing. In any case, the desire to keep the product and the starting culture closely linked, i.e. the Italian one, is underlined, trying without imposing itself to integrate and adapt to the target one.



Figure 6. Barilla
Source: WeChat, 2022



Figure 7. Galbani
Source: WeChat, 2022

4. CONCLUSION AND FUTURE FINDINGS

Following the analysis of the structure of storytelling, the language of communication in advertising, and finally after the presentation of the panorama of Italian exports to China and how the reference market is structured, the analysis investigated cases of some advertising messages of Italian food companies, to assess the difference in communication and strategies adopted.

It is evident that storytelling, although with different approaches, has, as seen, direct effects on business. However, it is not a one-shot operation but a long-term and wide-ranging planning that touches every aspect of corporate communication and that, for this reason, goes together with content marketing.

Audience involvement is central. The objective is not simply to respond to a buyer's need through a product/service, but to seek brand values with which consumers can identify. In this sense, the company must be able to tell its story and convey principles shared by the target audience, so as to establish a deep and lasting connection that goes beyond the act of purchasing.

After answering the research questions, to understand which strategies have been adopted by small-medium-large enterprises to promote Italian products into culturally distant markets such as China and which strategies are effective, in order to be considered also for a future business since the storytelling could be applied to all product and service with required a high personal involvement, it became interesting to think about this strategy could benefit from digital strategies.

As seen, companies can use storytelling to share information and make valuable connections. Digital storytelling is the 21st century's answer to story-driven marketing and could offer an additional solution to meet business goals. Moving on to digital strategies, we can state that technology is an increasingly important part of just about everything people do here in the digital age since they rely on it to stay in touch with loved ones, earn their livings, and keep themselves entertained in their off-hours.

If technology represents a massive part of how people organize, tell, and share their essential narratives this could be central also in the marketing and communication world. That said, today's consumers do not just want great products to buy and services to make their lives easier, they want to feel personally connected to the brands they buy from. It, therefore, seems interesting to intrigue how digital storytelling can be an effective key to meeting this need, combining the power of a good marketing story with modern and innovative tools to reach the target audience.

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Usage of Fear of Missing Out in Promotional Activities – A Research Agenda

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Abstract: *Fear of missing out (FOMO) can be defined as an individual's pervasive apprehension that others might be having rewarding experiences from which one is absent. Fear of missing out can be considered to arise from deficits in one's need satisfaction and, considering the fact that purchasing behaviour is generally driven by various needs and wants, usage of FOMO-based appeals holds the potential to amplify the effectiveness of those appeals, and the overall effectiveness of promotional activities. This paper provides a research agenda discussing the FOMO phenomena and its implications for promotional activities, primarily highly-targeted ones conducted in digital environments.*

1. INTRODUCTION

In an increasingly interconnected world, individual consumers are saturated with information that is constantly available through personal electronic devices. Wide use of information technology and its applications in everyday life, combined with its evolution into the consumer's central hub for entertainment, information gathering and interpersonal communication (primarily through the form of personal mobile devices) brought along the rise of digital promotion through various channels and media. In such an environment, competition for one's attention is fierce and the drive to increase the effectiveness of promotional communication is constant. While there are no rigorous studies on the subject, various estimates talk about individuals in developed countries being exposed to up to 10.000 ads per day (Simpson, 2017), through various media. Promotional electronic communication takes many forms – from 'classic' display ads appearing on websites and various platforms (music and video streaming etc.), targeted e-mails to posts that are embedded in social media feeds. One of the direct consequences of the information overload one experiences due to being exposed to such a vast amount of commercial messages has been 'banner blindness' – a consumer's propensity to ignore content that resembles ads in digital media (Pernice, 2018). Such developments have contributed to the rise and increasing importance of highly targeted, personalized communication which is delivered through various digital means (one of the most prominent examples being the use of e-mail marketing).

However, even when using more direct, personalized types of communication channels the question of how to formulate the content for maximum effectiveness remains. Similarly to traditional advertising, promotional messages in the digital context are based on appeals. Depending on the content and its presentation, appeals used can be categorized as either emotional or rational, with emotional appeals being more effective (Hornik et al., 2016). One of the questions which arise when talking about this topic is the question of the effectiveness of different types of emotional appeals. Furthermore, due to personalised nature of digital communication, there is also concern that certain types of emotion based appeals can be seen as intrusive, and thus

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be counterproductive. If this is the case, it would be of high practical value to define a set of determinants influencing the effectiveness of various emotion based appeals – depending on the types of products advertised and consumer characteristics. In this paper, the author strives to deal with the role of appeals based on the so-called ‘Fear of missing out’ in digital promotion.

2. FEAR OF MISSING OUT

Fear of missing out (FOMO in the remaining text) is a concept that, while not new in terms of its underlying mechanics, has emerged relatively recently in academic studies. One of the more commonly cited definitions of FOMO has been provided by Przybylski et al. (2013). These authors define FOMO as “*an individual’s pervasive apprehension that others might be having rewarding experiences from which one is absent*” (p. 1841), resulting in the constant desire to stay up to date with other’s activities. Basing their inquiry of FOMO on Deci and Ryan’s (1985) self-determination theory, Przybylski et al. view FOMO as a self-regulatory gap that originates as a consequence of either acute (situational) or chronic lack of psychological need satisfaction. Basically, FOMO results in an outcome which, in terms of its consequences is similar to social ostracism (Gupta & Sharma, 2021). While in their view FOMO is observed through the lens of social interaction with other individuals and hence related primarily to use (and abuse) of social media, it could be argued that there are other – promotional implications of FOMO which are worthwhile of inquiry. As Boström (2021) notes, consumer desires are developed through an individual’s social life which is deeply shaped by consumption forces. Hence, when discussing FOMO as a consequence of deficits in one’s social need satisfaction, consumption and activities related to it (including communication) should be considered. Indeed, it would be reasonable to state that consumption is a social or at least socially driven process of need satisfaction in which usage of FOMO-themed appeals could potentially amplify the effectiveness of promotional appeals and the overall effectiveness of promotional activities.

Literature views sources of FOMO as both internal and external. Viewed as an internally driven phenomenon, FOMO arises as a consequence of the human need to belong, which is then gratified by seeking attachment and belongingness to social groups (Franchina et al. 2018). When separated from or excluded by members of society, individuals feel anxiety and a strong impulse to imitate and follow the behaviour of others to resolve that anxiety (Elhai et al. 2016). With information technology expanding human interaction into the virtual sphere, social behaviours driven by FOMO are largely extended into the digital domain.

When talking about externally induced FOMO, it relates to (primarily) promotional messages aimed at nudging consumers to overcome their hesitancy or resistance, to perform an action (primarily purchase-related), or using scarcity appeals (which aim to raise concern in the consumer by creating perceptions of limited supply or limited time deals) (Hodkinson, 2016).

Everyday usage of modern information and communication technology introduced a new dimension to the dynamics of FOMO – namely, evaluation of external information, delivered through electronic channels and smart devices, and specifically tailored for an individual.

3. FOMO IN ADVERTISING APPEALS

While, in terms of their content, appeals themed around FOMO are not strictly emotion-based, their targeted impact is emotion-inducing. When talking about commercial FOMO-based appeals, Hodkinson (2016), defines them as “*any initiating appeal, whether in person or impersonal,*

originating from an organisation, in which FOMO or 'missing out' is mentioned or specifically implied and the context of which is the stimulation of demand, usage or purchase of a product." (p.3). The potential for usage of FOMO-based appeals stems from their effectiveness in driving individuals into action. FOMO has been linked with increased engagement, continued usage of communication technology and higher rates of engagement on social media (Przybylski et al. 2013), as well as significant responses which include commercial (related to purchases) ones (Hodkinson, 2016). However, such appeals have also been linked to significant cognitive and affective load among targeted audiences (Hodkinson, 2016), which raises questions about the potential drawbacks of their (over)use. Additionally, FOMO has been shown to have a mediating effect between scarcity and impulse buying (Zhang et al. 2022) which could further add to negative reactions to FOMO-based appeals should those purchases be deemed as unnecessary after the long-term evaluation by the consumers.

While undoubtedly effective in motivating individual actions, and in addition to some drawbacks already emphasized above, FOMO has also been linked with negative behaviours and emotional reactions. Specifically, FOMO has been linked with the overuse of technology and consequent negative emotions such as frustration, anxiety and mental exhaustion (Hetz et al., 2015), as well as excessive use of social media and depression (Baker et al., 2016; Gupta & Sharma, 2021). Hence, with such potential for both effectiveness and adverse affective reactions, there is a clear need for an additional inquiry into the potential for the use of FOMO-based appeals in the promotion. The focus of such research should be on optimal conditions and modes for the application of such appeals, as well as on identifying scenarios in which their usage should be avoided, i.e. when they could prove to be counterproductive.

4. DIGITAL PROMOTION AND PERSONALISED COMMUNICATION

As it has already been noted in the introductory sections of this paper, the world we live in is interconnected in manners never seen in human history. Development of information technology, particularly during the past 30 years, was characterised by parallel trends of rapid increase of computing power of personal devices and decrease of their physical dimensions and cost. Such development led to a situation in which the extent of penetration of smartphones, computers and other communication devices is high both in developed, but also in developing parts of the globe. Deloitte (2017) reported that the penetration of smartphones alone is above 80% in the majority of countries included in their study (both highly developed and developing), while use of all types of mobile phones was above 90%. Considering the COVID crisis and its additional push towards digitalisation and usage of IT technology, those numbers are likely to have increased.

One of the profound changes which happened in the digital communication landscape, and which directly shaped the way digital communication is used for commercial purposes nowadays was the rise of the so-called 'content marketing' (Forsey, 2022). Due to several changes in digital marketing practices which happened during the second decade of the 2000's an increased emphasis in shaping digital communication was placed on the technical and content-related adjustments of materials for new ways and algorithms according to which the content was served to consumers. Additionally, this era saw the rise and maturing of novel media and channels – namely, various forms of social media which realised their full commercial potential during this period. However, this was also a turbulent period during which some, potentially troubling applications of social media promotion were also realised (a prime example of which was the Cambridge Analytica scandal). As a result, additional pressure was introduced by various

stakeholders towards imposing better privacy controls and regulatory oversight of large IT companies (Facebook/Meta, Google, Amazon, etc.) which profited most from all the data collection opportunities offered through the extensive usage of the Internet-based services by individuals.

As a result of all these trends, it is likely that in the future the emphasis in terms of digital marketing communication activities will be on more personalised communication backed by first-party data collection efforts. Such trends are already visible as they have been recognised by [Turner \(2023\)](#) as one of the major focus points for marketers in the coming year(s).

Hence, what can be expected is the increased use of channels and media which allows for more targeted communication and an increased emphasis on creating value through such communication. One such channel is certainly e-mail, which – although one of the oldest services available on the Internet is simultaneously one which is fairly resistant to changes and problems in the environment. One of the advantages of e-mail marketing as a digital marketing tool lies in the permission-based nature of the relationship built through it. As [Hartemo \(2016\)](#) notes, e-mail – through systematic personalisation and thanks to its interactivity, can be perceived as empowering by consumers if used properly. Therefore, one of the important questions for future use of e-mail in particular and personalised communication, in general, will be how to design messages for maximum effectiveness while avoiding negative reactions. Examining the effects of different types of promotional appeals in this situation becomes ever more important since customer acquisition will become harder and losing costlier, as more control over consumer's data is handed over to the consumer.

5. FUTURE RESEARCH DIRECTIONS

Based on the overview provided in the previous discussion some of the questions arise as a research agenda for future inquiry into the application of FOMO-themed appeals in promotional activities in general, and promotion through digital channels (e-mail) in particular arise. Those questions will now be briefly discussed.

Considering increased engagement which has been linked with FOMO in a social media context, would the usage of FOMO-based appeals result in more effective promotional activities when talking about personalized communication, particularly in the context of building awareness and inciting consideration among the consumers? In the context of e-mail communication, would such messages result in higher open rates when compared with messages which are not based on FOMO-based appeals?

Would usage of FOMO-based appeals more often result in intended behavioural outcomes when compared with communication that is not based on FOMO? In the context of direct e-mails, would FOMO-based campaigns result in higher conversion rates (performing the targeted action) by the consumer?

Considering the adverse psychological effects which have been linked with FOMO and discussed in the paper, could extensive usage of FOMO appeals in communications result in avoidance behaviour by the consumer? In terms of e-mail communication, this could be measured by comparing the number of consumers who have unsubscribed from FOMO-based campaigns and campaigns not using FOMO.

Which specific circumstances or consumer characteristics (psychographic, economic, social, demographic, etc.) influence the effectiveness of the FOMO appeals? Further research into underpinning dynamics determining the effectiveness or the lack thereof of FOMO is warranted considering the trends and expectations in terms of the future development of digital communications.

6. CONCLUSION

This paper provides a look into the topic of the usage of appeals based on fear of missing out and discusses the potential outcomes of such practices. While FOMO has been extensively discussed in literature focusing on its effects on individual behaviour in the context of social media usage and individual mental health, research on the practical implications of the usage of FOMO-based appeals in marketing promotion is limited. Thus, the author hopes to contribute to this inquiry by providing an initial framework for future research, focusing primarily on the implications and outcomes of the application of FOMO in highly personalized communication. The paper provides research agenda which aims to further both practical and theoretical understanding of the dynamics of FOMO-based communication and its practical value.

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Supplying Critical Materials in a Time of Uncertainty

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Abstract: *The high demand for energy, food, and raw materials is putting an enormous strain on ecosystems around the planet. Therefore, the industrial strategies of many countries rely on the so-called green plan and transition toward climate neutrality. In this sense, the need for new materials greatly exceeds the existing possibilities and capacities. Critical materials are raw materials that have great economic importance and for which there is a probability of shortage. Since the world is facing more and more serious problems, whether it is an economic crisis, a pandemic, or war conflicts, the general character of the present and, one would say, future time, is uncertain. Prediction of uncertainty is a task that decision-makers must keep in mind when deciding on the present and the future, not only of economies but of entire ecosystems and populations as a whole. The paper shows how critical materials affect development and growth, and the fulfillment of environmental requirements, using examples from various industries.*

1. INTRODUCTION

The question of energy transition was raised several decades ago when it was realized that fossil fuel supplies are drying up and that they are finite. Since then, the attention of world forums, country leaders, scientists, and businessmen, as well as "ordinary" citizens around the world has been focused on renewable sources, which include solar energy, wind energy, hydro-power, biomass energy, and biofuel.

For years, there has been a debate in the world about how to meet the increasing demands of manufacturers in the automotive, computer, aviation, and power industries. Substitution methods and real analyzes of the availability of various minerals and metals are being researched more and more with the aim of securing them for a longer period. It is already known that the accelerated trend of switching to electric cars is fraught with serious obstacles because a large amount of lithium is needed for the production of batteries to start these cars. Bearing in mind that the production of lithium is accompanied by many environmental problems, its extraction, and further processing will not fulfill one of the three elements of the energy transition – environmental sustainability.

Since the world is facing more and more serious problems (economic crises, pandemics, or war conflicts), the general character of the present and future times is uncertain. Uncertainty is a phenomenon that deviates from the normal state and takes different forms in relation to imminent risk.

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2. STRATEGIC (CRITICAL) MATERIALS

The term "strategic materials" does not refer to any specific industry. "Strategic materials" transcend the boundaries of many industries – from mining to those that convert raw minerals into usable materials, to those that use materials in the production of intermediate products and end products for civil and military use. In this regard, strategic materials should be categorized along two lines: 1) traditional materials – which have been used for many years, and 2) advanced materials – many of which have recently been created or are still being developed.

Strategic or critical materials are materials (minerals, metals) whose lack or impossibility of procurement has consequences for "carrying" branches, such as the automotive, aviation, computer, and military industries, and electric power. They are found in alloys, magnets, batteries, catalysts, and polishing compounds, which in turn are integrated into countless products such as aircraft, communication systems, electric vehicles, lasers, naval ships, and various types of consumer electronics and lighting. Some of these materials are difficult to obtain, and the technologies for their extraction, processing, and finalization are associated with high costs and environmental problems. Given their necessity in a multitude of technological applications, there is a legitimate concern as to whether the supply can meet the needs of industries in the future. Material criticality is assessed in terms of supply risk, sensitivity to supply constraints, and environmental implications (Graedel et al., 2015).

A particularly important group of materials are rare earth elements (17 elements) that are used in various products. There is no readily available substitute for them, so shortages will cause problems in the production of mobile phones, computers, energy-efficient lighting, permanent magnets for wind turbines, hybrid vehicle batteries, oil refining, and automotive catalysts. In 2020, China controlled almost 60% of the production of rare earth elements. The United States is 100% reliant on imports for 14 critical minerals and more than 75% reliant on imports for another 10. These materials are critical to industrial and commercial processes as well as national defense (Hanson, 2011).

The proclaimed faster transition to renewable resources and reduction in the use of fossil fuels points to the trend of electrification in the automotive industry. As automakers race to position themselves in the transition from internal combustion engines to electric vehicles, and expect hundreds of billions from that transition, problems with the supply of the necessary materials are challenging such optimistic expectations.

In order to realize the expectations, they will need a lot of batteries, which means that it is necessary to mine, process, and adapt a lot of minerals (e.g. lithium, cobalt, or nickel). These minerals are not particularly rare, but their production needs to increase at an unprecedented rate to meet the ambitions of the automotive industry. On the other hand, the existing supply chain is dominated by one country – China. It controls about three-quarters of the market for minerals necessary for the production of batteries, although it does not have the richest deposits – they are in the Congo, Australia, and Chile. However, China is determined to dominate the processing of these minerals, it has the economic strength, capital, huge market, and the will to make it happen, so such a performance causes concern in the West.

Meanwhile, the conflict in Ukraine has created a new kind of anxiety. Although a much smaller player in supply chains than China, Russia supplies a significant amount of nickel to global

markets, which has seen prices of the mineral rise since the conflict began. The global demand for nickel for the production of lithium-ion batteries was more than 150,000 tons in 2019 (Al Barazi et al., 2021), which is less than 5% of the volume of the world's primary nickel market. By 2025, demand in the electric vehicle sector could increase to approximately 500,000 tons per year, equivalent to 15% of the total global market.

To increase the energy density of lithium-ion batteries, a much higher proportion of nickel is used in the cells. This means that demand will increase disproportionately to the increase in battery production. Nickel sulfate, essential for lithium-ion batteries, is a targeted class 1 nickel product (over 99% purity). In order to meet the growing demand in the future, it is necessary to develop new production methods for nickel sulfate. The market is highly dependent on the supply of primary nickel from Southeast Asia, particularly Indonesia. After China, it is the second largest producer of nickel in the world, but only of class 2 nickel (less than 99% purity).

Automakers aren't just worried about geopolitical risks; they're deeply concerned about the number of minerals they need. The companies that produce lithium are becoming aware that they cannot just "enter" the business and secure the supply because it is not defined by either capacity or quantity. Therefore, General Motors, Volkswagen, and BMW are taking the unusual step of buying minerals directly from mines, and in some cases even investing in them, in order to secure the necessary resources. Tesla, the revolutionary manufacturer of electric cars, has been working directly with mines for years and providing the necessary minerals for itself.

The specificity of the present moment is the increase in the prices of key minerals needed for the transition to "clean" energy. Thus, the prices of lithium and cobalt have more than doubled in 2021, and the prices of copper, nickel, and aluminum have increased by 25% to 40%. The price trends have continued in 2022, so the price of lithium has increased by an incredible two and a half times since the beginning of the year. Prices of nickel and aluminum – for which Russia is a key supplier – also continued to rise. For most minerals and metals, price increases in 2021 significantly exceed the largest annual increases recorded in the 2010s (IEA, 2022).

Raw materials now have a significant and growing share of the total cost of clean energy technologies. For example, cathode materials – which are essential for lithium-ion batteries and include lithium, nickel, cobalt, and manganese – accounted for less than 5% of the battery's cost in the middle of the last decade, and there were only a few large battery factories then. That share has grown to over 20% today with around 300 large factories in various stages of planning and construction worldwide. Higher cathode material prices in 2021 increased lithium-ion battery costs by about 5% from 2020 levels (IEA, 2022).

The global electric car fleet grew to 10.9 million vehicles in 2020, an increase of 1 million compared to 2019. With more than five million electric cars, China is still the undisputed leader, followed by the USA with 1.77 million and Germany with almost 570,000 electric vehicles (Diess et al., 2021). In 2020, the number of registered electric cars reached a record 3.18 million units. From 2030 onwards, they could account for between 25% and 75% of new registrations, leading to demand for batteries with capacities of 1 to 6 TWh per year (Thielmann et al., 2020).

Forecasts say that lithium-ion batteries will be the standard solution for electric cars in the next ten years, so the main materials needed for the production of batteries will be graphite, cobalt, lithium, manganese, and nickel. According to estimates from the Fraunhofer Institute in Munich, the

proportion of lithium in each battery cell of around 72 g/kg will not be noticeably reduced. However, the proportion of cobalt could be significantly reduced from 200 g/kg to about 60 g/kg per cell (Neef & Jung, 2021). Thus, the demand for primary raw materials for the production of car batteries by 2030 should be between 250,000 and 450,000 tons of lithium, between 250,000 and 420,000 tons of cobalt, and between 1.3 and 2.4 million tons of nickel.

When evaluating raw material deposits, two different figures need to be taken into account: on the one hand, the resources that are generally available on Earth and, on the other hand, the deposits that are profitable using today's technologies. In most cases, total deposits significantly exceed anticipated demand, even if the number of raw materials required would simultaneously increase as a result of higher demand in other areas. However, several studies indicate that temporary shortages or price increases of certain raw materials are possible. The situation differs significantly among different metals, as a detailed analysis and assessment by the German mineral resources agency DERA shows (OECD, 2022).

Graphite is used as the anode material in lithium-ion batteries and has the largest volume fraction of all battery raw materials, thus affecting a significant part of cell production costs (Schäfer, 2021). China has played a dominant role in almost the entire supply chain for several years and produces about 50% of the world's synthetic graphite and 70% of flake graphite.

Like nickel and manganese, cobalt is essential for battery cathodes. It currently represents the greatest procurement risk of all battery raw materials, especially due to dynamic demand growth and potential supply bottlenecks. The demand for cobalt for electric vehicles could increase to as much as 315,000 tons by 2030, which is 20 times the current amount (Backhaus, 2021).

In the lithium market, a significant increase in demand is expected compared to current production levels. According to the forecasts of the agency DERA, by 2026 the supply of lithium needs to triple in order to cover the future demand. Lithium extraction is currently limited to Australia, Chile, and Argentina and to a few companies, with just four companies controlling nearly 60% of global production (Al Barazi et al., 2021).

From batteries to solar panels and wind turbines, the rapidly decreasing cost trends seen over the past decade have largely reversed in 2021, with wind turbine and solar PV module prices up 9% and 16%, respectively. In China, the increase in lithium prices is already reflected in higher prices of electric vehicles – Tesla, BYD, and Xpeng announce price increases of 2% to 9%.

Battery applications make up only a small part of the manganese market, as only about 0.2% of the manganese mined worldwide is currently used in lithium-ion batteries. In the future, this figure will only increase to about 1%.

Although Russia is a major producer of many minerals and metals, the country's increasing international isolation is putting additional pressure on already tight markets. The first impacts were felt on aluminum markets, where in 2020 Russia accounted for 6% of world production (second largest producer in the world) and 8% of EU imports. Since aluminum production is highly energy-intensive, the high prices of natural gas and electricity have already affected almost half of the EU's production capacity at the beginning of 2022. With supplies also reduced in China, aluminum prices rose to record highs following the start of Russia's operation in Ukraine, causing stress in many industries.

Russia's share in nickel production is around 10% at the global level, but almost 20% of the supply of class 1 nickel is needed for the production of batteries. It is also the second-largest producer of cobalt and the fourth-largest producer of graphite. Russia also provides 43% of the global supply of palladium, a precious material used in catalytic converters in cars. More than half of Russian palladium exports go to Europe. Car manufacturers have the option of opting to use platinum, but Russia is the second largest producer of platinum in the world with a 14% market share.

The situation is different in terms of renewable energy technologies, which include solar and wind energy, hydropower, biomass energy, and biofuels. In the last two or three decades, there have been significant scientific advances in the application of these energy sources, which has reduced the price of the necessary minerals-metals. However, similar to car electrification, there are several countries that have primacy in the research, development, and production of parts, assemblies, and finished products. These are China, Japan, the USA, Germany, Canada, and Great Britain.

The first generation of solar photovoltaic modules was made of silicon with a crystalline structure. The two most basic types of silicon used in solar PV modules are monocrystalline and multi-crystalline silicon. Monocrystalline silicon has a higher efficiency compared to multi-crystalline. On the other hand, multi-crystalline silicon is cheaper, so manufacturers use it for low-cost solar systems. Amorphous silicon is a non-crystalline allotropic form of silicon that is also widely used in solar photovoltaic equipment in thin film technology (Gul et al., 2016, Li et al., 2021, Li et al., 2021).

Cadmium and tellurium are also used for the development and production of solar photovoltaic systems. They are mixed in a specific ratio to develop cadmium telluride solar cells and are considered the most efficient thin film material. Compound semiconductor solar photovoltaic devices are made of gallium and arsenide. Aluminum, antimony, and lead are used in solar photovoltaic equipment to improve the energy range. Other materials used to develop advanced solar photovoltaic cells are copper, indium, gallium, and selenium.

3. PROVISION OF STRATEGIC MATERIALS IN TIMES OF CRISIS

In the last fifteen years, the world has experienced a series of destabilizing events. During this period, multilateral processes were weakened, political leadership was often lacking, and global unity was at a low level.

A crisis means a severe, all-encompassing disturbance in social life (political and economic) from which the exit is very difficult and usually long-lasting. Crises represent an obstacle, an important change that interferes with normal work and causes another phenomenon as its consequence.

Accelerating the energy transition is essential for long-term energy security, price stability, and national adaptability. About 80% of the world's population lives in countries that are net importers of energy. With an abundance of renewable energy sources yet to be tapped, this percentage can be dramatically reduced. A deep shift would make countries less dependent on energy imports through different supply options and help decouple economies from large swings in the price of fossil fuels.

The electrification trend, as a response to the "green agenda", has caused major disruptions in the market for materials needed to produce batteries to power cars. This applies not only to lithium but also to other minerals-metals whose availability is uncertain, insufficient, or impossible. The leading economies of the world, such as the USA, Germany, China, Japan, and South Korea, are concerned not only about the current stage of development of renewable energy technologies but also about further growth and development. In addition to major disruptions in the energy sector, technological upheavals are expected in the next ten to fifteen years that will shape economic progress or new crises in the world.

The current global situation highlights the importance of addressing market and supply chain disruptions as interconnected systemic risks. While the circumstances of the current crisis are extraordinary, the direct impacts and cascading risks it has contributed to – high resource prices, supply chain disruptions, market volatility, economic conflict, energy and food insecurity, displacement, migration, and geopolitical uncertainty – are extraordinary.

Access to resources is a strategic security issue for Europe's ambition to fulfill the European "Green Deal". The new industrial strategy for Europe identifies raw materials as key drivers for a globally competitive, green, and digital Europe. The European Union and the United States of America have been compiling a list of critical materials for years; the shortage, lack, or inability to access them causes disruptions in all branches of industry. It is logical that all EU member states do not have the same potential or the same needs for critical materials. However, the EU expresses a common concern for the supply of the necessary materials, because the prosperity of all member countries and further economic development and growth depend on them.

The concept of Industry 4.0, present for more than a decade, is based on powerful computers, the Internet, communications, networks, and big data. Powerful computers require semiconductor materials with exceptional specifications, materials that will enable new platforms, and faster data transfer, analysis, and use.

The semiconductor industry has seen a huge increase in demand. Revenues from global semiconductor sales have nearly doubled over the past decade, with Asian economies consolidating their market dominance in this regard. At the start of the Covid-19 pandemic, when shipments of semiconductors to the automotive industry declined globally in the second quarter of 2020, this shortfall was offset by strong demand for computer and electronic equipment. After the global recovery took place, semiconductor production was not enough to meet the surge in demand in the automotive industry. The production of semiconductors is very profitable, and the number of companies engaged in this production in the world is very small compared to the growing needs (Radić & Radić, 2021).

Top semiconductor companies are focused on one product segment or one step in the value chain, as intensive research and development effort is required to maintain manufacturing leadership. Today, there is no local market or company that has all the capabilities (and capacity) needed to design and manufacture semiconductors from start to finish. If a major supply chain disruption occurs, similar to that caused by the Covid-19 virus, there could be production bottlenecks and shortages of certain semiconductors. The semiconductor market surpassed \$100 billion for the first time, thanks to a strong increase in revenue from semiconductors for mobile phones. Sales in 2021 increased by 16% compared to 2020 due to the global crisis caused by the pandemic.

Industrial ecosystems such as construction, automotive, low-carbon energy-intensive industries, and aerospace are highly dependent on secure access to raw materials. By 2030, these industrial ecosystems will have a combined added value of 2000 billion euros and provide employment for more than 30 million people in Europe.

Similar to the crisis caused by the Covid-19 pandemic, the current crisis in Ukraine has disrupted established supply chains, disrupted logistics operations, increased the prices of almost all critical materials, and made some unavailable. That is why any planning is accompanied by risks that will not be realized, so managing risks, as well as crises, becomes a constant task of states, governments, leaders, and academic and industrial communities.

4. CONCLUSION

Observing crises from multiple aspects allows for predicting events in the near future. As much as a commitment to renewable energy is the subject of various conferences, leaders' agreements, and scientific research work, the lack, and availability of various materials for the energy transition stop growth and development. Also, everything said about critical and other materials refers to the most developed countries in the world, and the source of the necessary materials is most often African, Asian and from some other countries. Therefore, it can be concluded that Congo, Chile, or Indonesia will not profit from the mining and sale of lithium, manganese, cobalt, aluminum, and nickel, but those countries that have technological and economic strength and primacy will profit. On the other hand, it leads to an increase in the gap between the rich and the poor, as poor countries are forced to sell their ores, minerals, and metals at prices dictated by large and rich countries.

An uncertainty factor is present in the analysis of critical materials. For decades, talk has been about silicon and germanium as starting materials for semiconductor technologies. Also, extensive research has been carried out for decades on substitute materials that will have better properties than silicon and germanium. Those materials must be produced, and production depends on the amount of mined ore, its processing and the process of finalization into usable materials. So, it's not all about the wishes of potential users of new or better materials, things are connected on the research, development, and production level.

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Natural Management and the Development of Protected Areas as Sustainable Tourism Spots in Bosnia and Herzegovina

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Abstract: Bosnia and Herzegovina's Nature Protection Law complies with significant European directives and conventions intended to safeguard habitat and biodiversity. The objectives of the paper are to investigate Bosnia and Herzegovina's legal framework for managing natural resources and to identify protected areas as the spots of sustainable tourism. Bosnia and Herzegovina is home to a wide range of biodiversity due to its three distinct geographical zones, the Mediterranean, Euro Siberian-Bore American, and Alpine-Nordic Highlands. As a result, more protected areas are being established, with Sarajevo creating the first protected area that adheres to IUCN guidelines. Recently, new protected areas have been added to Bosnia and Herzegovina's tourism supply to meet the rising demand for natural places. Bosnia and Herzegovina is perceived as an ecotourism destination by the majority of its citizens, hence the trend toward protected areas is seen as favorable.

1. INTRODUCTION & THEORETICAL BACKGROUND

According to Muralikrishna & Manickam (2017), natural Resource Management (NRM) refers to the sustainable utilization of major natural resources – ecosystem services (land, water, air, minerals, forests, fisheries, and wild flora and fauna) that provide a better life. IUCN is considered one of the most influential conservation organizations and, together with WWF and the WRI, is seen as a driving force behind the rise of the influence of environmental organizations at the UN and around the world. The EU has been committed to the protection of nature since the adoption of the *Birds Directive in April 1979*. The Habitats Directive was adopted in 1992 to help maintain biodiversity. It also established the EU-wide Natura 2000 network of protected areas. Major EU international agreements related to nature & biodiversity are *Bonn CMS Convention (1979)*, *Bern Convention on European Wildlife and Habitats (1979)*, *Alpine Convention (1991)*, *Ramsar Convention (1971)*, etc.

IUCN protected areas are important not only for conserving ecosystems and habitats, as well as associated cultural values and traditional natural resource management systems, but they are also very valuable in terms of tourism. Protected areas are focal points of ecotourism, with „returning to nature“ as a popular trend globally. Protected areas are recreational sites and tourist destinations, and they are also nodes of sustainable tourism in terms of legal foundation, protection regime, and management control.

Since 2003, Bosnia and Herzegovina has been working to implement and expand its protected area system in accordance with IUCN guidelines. It recently recorded about 4% of protected territory, whereas the third category is mostly represented in the overall structure of protected

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areas. Protected areas are viewed as destinations for sustainable tourism, and their significance in this context is growing not only on a global scale but also on a state level in Bosnia and Herzegovina.

Table 1. IUCN protected area management categories with tourism exploitation options

Category	Description	Exploitation
Ia - <i>Strict Nature Reserve</i>	Origin nature; strict protection; limited use	Science, scenic
Ib - <i>Wilderness Area</i>	Nature without human habitats; strict protection; limited use	Science, restricted tourism
II - <i>National park</i>	Nature, ecology, and culture; extensive ecosystem protection; wider use	Science, education, recreation, organized tourism
III - <i>Natural Monument or Feature</i>	Smaller natural areas, single forms or features; protection of specificity only; wider use	Science, education, recreation, significant tourism
IV - <i>Habitat/ Species Management Area</i>	Certain habitat or species; management interventions; specific use	Biodiversity conservation and restauration
V - <i>Protected Landscape/ Seascape</i>	Area of nature and human interactions; conservation of integrity; wider and alternative use	Promotion, education, massive tourism, organic agriculture optional
VI- <i>Protected area with sustainable use of natural resources</i>	Large areas with natural, cultural and traditional systems; sustainable use of natural resources	Non-industry activities: forestry, agriculture; presence of people allowed

Source: Author

2. METHODOLOGY

The main objectives of the paper are to: a) research and present Bosnia and Herzegovina's legislative system of environmental and natural protection and management; b) investigate the tourism importance of protected areas; c) identify IUCN protected areas as tourism spots in the country. Spatial documentation and other secondary sources, as well as data collected during terrain work (observation, survey, interview), were used for the complex geographical and tourism analysis, identification, and evaluation related to the nature protection and tourist importance of protected areas. The survey on ecotourism in Bosnia and Herzegovina (157 respondents: locals and tourists) inquired about ecotourism awareness and demand. EU policies were observed, and the main acts and directives were presented to gain a better understanding of the nature of Bosnian laws, and the position of the country in the global efforts to protect nature and to increase its tourism exploitation.

3. BIOGEOGRAPHICAL PROFILE OF BOSNIA & HERZEGOVINA

Bosnia and Herzegovina is located on the Balkan peninsula (*land: 51,187 sq. km; water: 10 sq. km*) and bordering with Croatia, Serbia, Montenegro. Bosnia and Herzegovina is a developing country with a dominant tertiary-sector economy, including tourism as one of its strategic activities. It's a "blooming" tourist destination with a significant rate of tourism growth. The administrative constitution of Bosnia and Herzegovina is made up of two entities (FBiH, RS), and Brčko District, and is frequently referred to as "the world's most complicated system of government" (Nardelli et al., 2014).

The country is distinguished by the presence of highly diverse ecosystems, distributed from sea level in the European Mediterranean belt to the highest mountain peaks in the Alpine belt (*Mt.*

Maglić, 2386 m; Adriatic Sea, 0 m). There are three main biogeographical regions in Bosnia and Herzegovina: Mediterranean, Continental, and Alpine regions, which resulted in very rich and diverse ecosystems. „Bosnia and Herzegovina is one of the European hot-spot countries with a very high level of species and ecosystem diversity and high endemism rate“ (Đug & Drešković, 2012).



Figure 1. Political-administrative map of Bosnia & Herzegovina
Source: Author (based on Nardelli et al., 2014)

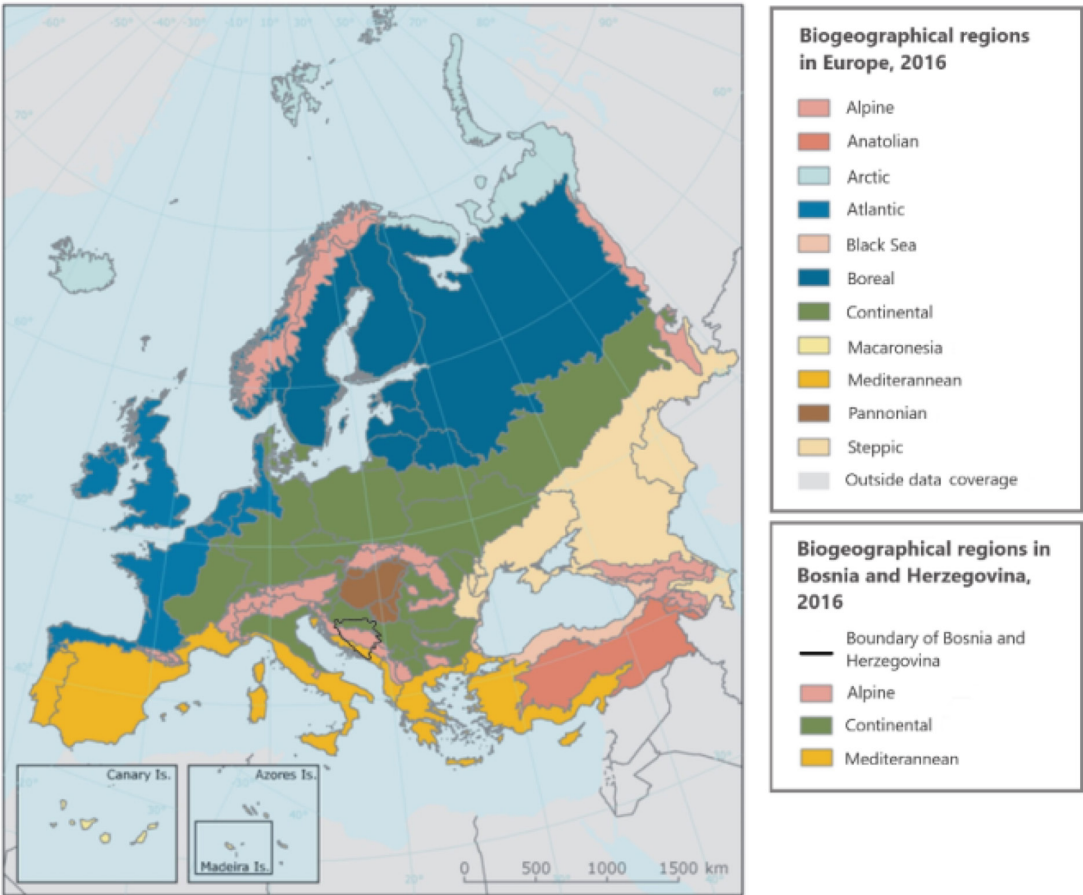


Figure 2. Map of biogeographical regions in Bosnia & Herzegovina
Source: Author (based on the map of the EEA, 2017)

According to the principles of the Convention on Biological Diversity, Bosnia and Herzegovina's biodiversity is based on gene diversity, species diversity, and ecosystem and landscape diversity. The country's topography is distinguished by a variety of landscapes: Dinaric (Alps) mountains, basins, and valleys (center); Pannonic flats and hills (in the north); Mediterranean karst (in the south). Its species diversity is characterized by the highest level of endemism in Europe, as well as an extremely high level of landscape diversity, which encompasses all forms of geological and biological diversity in the broadest sense. The country has a wide range of flora and fauna ecosystems:

- natural forests cover 44% of the total land area;
- 5200 taxon of vascular plants;
- 500 endemic plant species and over 400 endemic animal species (reptiles, birds, mammals, etc.);
- 11 cartilaginous fish species and 194 bony fish species, among others.

There are numerous development centers, endemic centers, and relict centers – refugium of tertiary flora and fauna—on BiH's territory that have survived to this day under specific climatic conditions. „Considering the number of species and its relatively small country size, the species density and diversity in Bosnia is among the highest in Europe“ (Đug & Drešković, 2012). „Bosnia and Herzegovina's flora, fauna, and fungi are among the most diverse in Europe, and its high degree of endemism and relictness makes it important in terms of global biological diversity“ (Federal Ministry of Environment and Tourism). „It is estimated that there are about 500 endemic plant species“ (Đug & Drešković, 2012). Bosnia and Herzegovina is home to 30% of the Balkan endemic flora.

Considering the country's surface area and the number of geological rarities discovered thus far, Bosnia and Herzegovina is one of Europe's most diverse countries. Geodiversity is still locally preserved despite pronounced anthropogenic influence, and it should be placed under an appropriate system of sustainable management. A high level of landscape diversity exists throughout the country as a result of the coexistence and high level of interactions between biological and geological diversity. Various landscapes can be distinguished: Mediterranean; Submediterranean; Mediterranean-mountainous; Peripannonian; Mountainous. Ecosystems with high natural values confer a special seal of uniqueness on the area of Bosnia and Herzegovina:

1. *High-mountain landscapes* are dominated by ecosystems of mountain meadows, and pre-mountain ecosystems of juniper pine, beech, fir, etc.;
2. *Diverse and polydominant landscapes in the refugia of Bosnia and Herzegovina*
 - a) *landscapes of relict pine forests* with Illyrian pine and munika ecosystems;
 - b) *landscapes of relict-refugial ecosystems in the canyons and gorges* (e.g. Una, Drina, etc.), which contain the greatest diversity of ecosystems and all forms;
3. *Marsh landscapes* (e.g. Hutovo Blato, etc.), mountain lakes (e.g. Prenj, Šator, etc.), and marshy mountain areas in the form of islands (e.g. Vranica);
4. *Complex ecosystems in karst fields and other karst forms* (e.g. Popovo field with hydrogeological and morphological phenomena–Vjetrenica cave, etc.).

The specific topography—relief, geological and pedological bases, hydrology, and climate, also contribute to Bosnia Herzegovina's extremely high level of biotope diversity. „Ichthyofauna with 11 species of cartilaginous and 194 species of bony fish represents a unique European biological resource considering both total richness and presence of numerous interesting endemic forms“ (Đug & Drešković, 2012). „The fish and reptiles have the highest degree of endemism“ (Dalmatin et al., 2008).

4. LEGISLATION ON NATURE AND ENVIRONMENTAL PROTECTION IN BOSNIA & HERZEGOVINA

4.1. Environmental Protection Framework in Bosnia and Herzegovina

Based on the Constitution of Bosnia and Herzegovina, the legal framework & responsibility in the field of *environmental & natural protection* is not institutionalized at the state level, but within the organizational structure of 2 entities' governments and Brčko District:

- *In the Federation of Bosnia and Herzegovina*, responsibility for environmental protection mostly belongs to the Ministry of Environment and Tourism of FBiH, but also to other institutions, including the partial responsibility of cantonal ministries;
- *In the Republika Srpska*, the competence mainly belongs to the Ministry of Spatial Planning, Civil Engineering and Ecology of RS, but also to other institutions;
- *In the Brčko district*, environmental protection policy is under the direct responsibility of the district government through the sector for communal activities and the sector for agriculture and forestry.

As defined by the Law on Ministries, the relevant authority for environmental issues at the state level is the *Ministry of Foreign Trade and Economic Relations* (MOFTER). More specifically, MOFTER is responsible for carrying out tasks related to defining policies and basic principles, coordinating activities, and harmonizing plans of the entity authorities and bodies at the international level for environmental protection, development and the use of natural resources. Based on decisions of RS and FBiH governments, an *Inter-entity environment body* deals with environmental issues which require a consolidated approach of both entities and it's in charge of the development of an inter-entity environment protection plan.

Bosnia and Herzegovina has signed and ratified major international environmental treaties, conventions, and directives (*EU Habitats Directive, SPA and Biodiversity Protocol, Conv. on wetlands of intl. importance, UN Conv. on Biological Diversity and Climate Change, Montreal and Kyoto Protocol, Aarhus Conv., the Birds Council Directive*, etc.) in order to ensure a more comprehensive approach with the primary goal of reducing human pressure on sustainability and directing this activity toward a more harmonious relationship between meeting human needs and environmental quality. The key documents related to environmental issues at the state level are: *NEAP BiH (2003)*, *UNEP MAP BiH*, *Strategy for Biological and Landscape Diversity of BiH* (2008), *Strategies for Environmental Protection* (at the entity, district, canton, and municipality levels), with the compatible set of environmental laws (2000-2003) at the entities' level. The environmental protection legislation of Bosnia and Herzegovina (since 2003) includes: "The Law on Environmental Protection"; "Law on Nature Protection"; "Air Protection Law"; "Law on waste management"; "Law on Water Protection"; "Law on the Environmental Fund".

4.2. Nature Protection in Bosnia and Herzegovina

"Nature conservation in Bosnia and Herzegovina began in the second half of the 19th century with the protection of certain types of venison. The Perućica was established as the country's first protected area (1954). Two months later, the National Institute for the Protection of Cultural Monuments and Natural Rarities of the Republic of Bosnia and Herzegovina, declared Prokoško Lake on Mt. Vranica a natural rarity. Sutjeska became the first national park (1962), and Perućica became the nucleus zone of this area" (*Žunić, 2022*). Nowadays, the jurisdiction

in the field of nature protection in Bosnia and Herzegovina is regulated at the two entities and Brčko District level. The basic legal acts on which nature protection is based, including categories of protected areas and protection procedures, are: “Law on Nature Protection of the Federation of Bosnia and Herzegovina”, “Law on Nature Protection of the Republic of Srpska”, and the “Law on Nature Protection of the Brčko District of BiH”. Documents related to the development of protected natural areas at the entities' level, in general, are: Spatial plan (FBiH, RS), Amendments to the Spatial Plan (RS), Environmental protection Strategy (FBiH, RS), Tourism development strategy (FBiH, RS). The management of PAs is more closely regulated at the cantonal level (FBiH) by regional self-government units' strategic development plans and at the proven level by spatial plans. Competencies at the state level (refers to the implementation of international agreement obligations) belong mainly to the *Ministry of Foreign Trade and Economic Relations of Bosnia and Herzegovina*, and to the *Ministry of Civil Affairs* (e.g. UNESCO Convention). “The Law on Nature Protection in Bosnia and Herzegovina” regulates principles of restoration, protection, preservation and sustainable development of landscapes, natural areas, plants, animals and habitats, minerals and fossils, and other components of nature, as well as competences of bodies that perform nature protection activities and planning, etc. It complies with international directives: *Bonn CMS Convention*, *Bern Habitat and Ramsar Wetlands Convention*, *The Birds Directive* SPA, *CITES*, *CBD Convention*, among others. Nature protection is accomplished by preserving biological and landscape diversity and protecting natural values. The law defines the preservation of biological and landscape diversity, forest and karst ecosystems, water and wet habitats, habitats and ecologically significant areas, as well as the European network of SPA (NATURA 2000). The law also defines regulations regarding the prohibition and risk of introduction of species and subspecies, protection of internationally protected species, transboundary trade in protected wild species (CITES), keeping, breeding, and trade of wild species, special protection of wild species and subspecies, identification of the endangered species („Red Lists“), protection measures of strictly protected species and subspecies, genetic diversity, autochthonous species and subspecies, and other related matters.

5. PROTECTED AREAS IN BOSNIA & HERZEGOVINA AS TOURISM SPOTS

5.1. Contemporary Trends and Evolution of Pas in the Country

Since its independence (1992), Bosnia and Herzegovina has established two national parks: NP Una (FBiH, 2008), as the first national park on the entity level – the largest one by its area and the most visited national park in the country, and NP Drina (RS, 2017). Since 2003, the implementation of the Nature Protection Law, which made the IUCN model of categorization of protected areas mandatory, has encouraged the development of protected natural areas in Bosnia and Herzegovina. Until the 1990s, protected areas were classified according to the *Law on the Protection of Cultural, Historical, and Natural Heritage*. Because some previous legal categories were not recognized by the IUCN, they were incorporated into a new category (for example, "nature park" and "regional park" correspond to the IUCN-V category of "protected landscapes"). The first new protected areas based on IUCN criteria were established in Sarajevo Canton ("Vrelo Bosne", "Skakavac", "Trebević", etc.). The total identified protected areas coverage in Bosnia and Herzegovina is now 3,46% of the country's territory, with 45 protected spots. If we add this to the IBA and RAMSAR protected territory, it's about 4,57% of the protected country's area. According to **UNEP-WCMC (2022)**, there are 65 PAs with coverage of 4,06% and management effectiveness evaluations of 1,35%. According to the official statistics, out of the total number of identified protected areas in the country (45), RS accounts for 73.3% and FBiH for 26.7%. However, the protected

areas in the FBiH are larger by their area than those in the RS, occupying 58.6% of the total protected territory in BiH. The majority of SPA about 70–75% is in FBiH (Hutovo blato, Livanjsko polje, Boračko jezero), while only 25–30% (Bardača) is in RS.

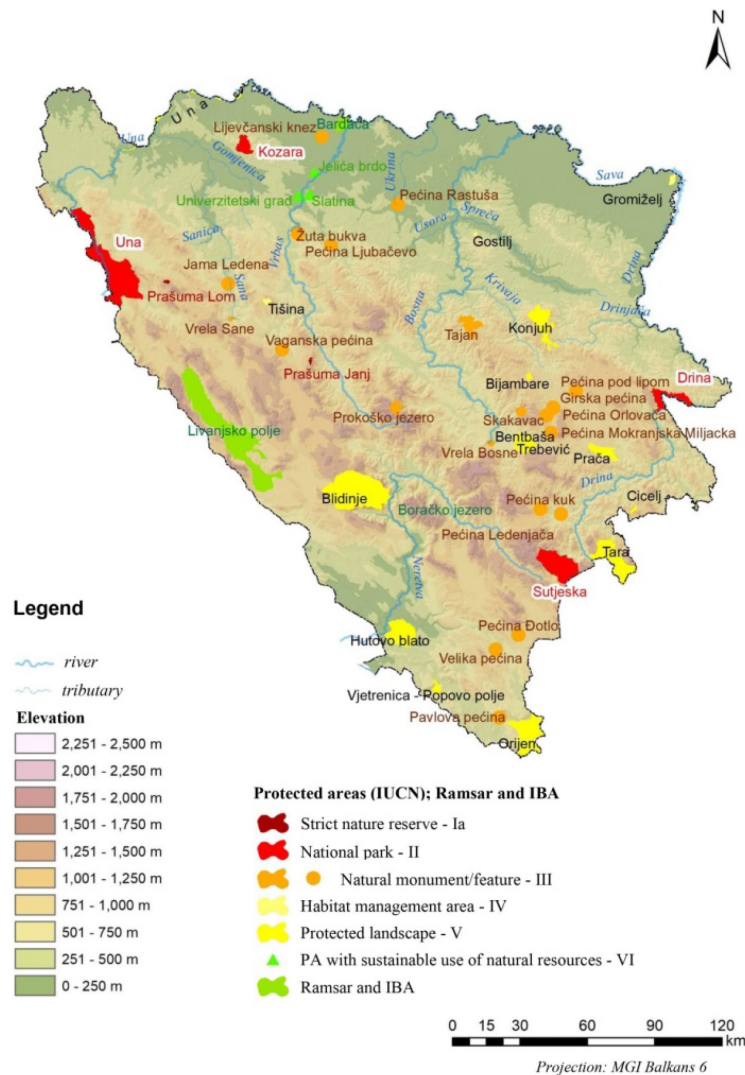


Figure 3. Map of protected areas in Bosnia and Herzegovina
Source: Author

From the map of identified protected areas in Bosnia and Herzegovina, regarding their spatial distribution, it's evident that they are dominantly present in the Alpine region.

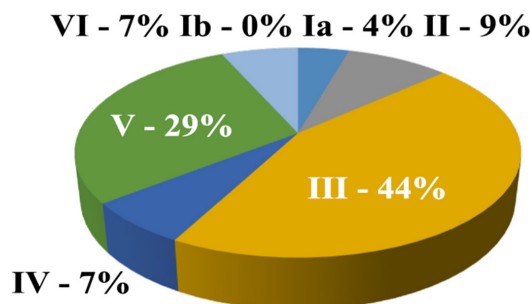


Figure 4. IUCN PA in Bosnia & Herzegovina (2022)
Source: Author (based on the official statistics of BiH PA)

From the chart above, the most represented categories in the Bosnia and Herzegovina PAN are III (*natural monument or feature*) with 44% and V (*protected landscape*) with 29%, accounting for 73% of the country's total protected area. There's no PA in the category Ib.

According to the spatial documentation, it is planned to protect about 16% of the state territory (FBiH: 17% of the total area, RS: 15.5% of the total area). However, Bosnia and Herzegovina is among the countries with the least formal protected territory in Europe. The main impediments to the efficient implementation of planning goals aimed at protecting nature are: anthropogenic pressure; fragmentation and destruction of habitats; excessive exploitation of natural resources; lack of sustainable and synchronized PA management due to the complicated political-administrative constitution; no PA in Brčko District; irrelevant evaluation of certain PA in Bosnia and Herzegovina, due to the lack of scientific approach. The IUCN recommends that each country protect at least 10-30% of its territory, whereas the global average is 14.7%, placing Bosnia and Herzegovina below both the international standard and the global average. However, „the regional average is 7%, so the goal is to expand PA and use their development potential, which has recently been supported by international institutions in Bosnia through various initiated projects. In accordance with the foregoing, Bosnia and Herzegovina doubles the proportion of its land area that will be designated as protected, from 2% to at least 4%“ (UN Environment Programme, 2017). According to data for 2022 (WDPA, UNEP-WCMC, Protected Planet), Bosnia and Herzegovina's reached 4% of its protected territory. Thus, it indicates some progress in the field of environmental and nature protection. Lately, there's been a positive trend in the growth of protected areas, mostly in the tourism categories (III, IV, V), and the number of protected areas increased from 29 IUCN PA (2016) to 45 IUCN PA (2022) in Bosnia and Herzegovina. „In addition to the existing national parks in BiH, it is planned to effectively protect the mountain areas as a key zone in the network of protected areas: a) the Olympic mountains (Igman, Bjelašnica); b) the mountains of Herzegovina's endemic center (Prenj, Čvrstica, Čabulja); c) Mt. Vranica; Šator; Grmeč; d) the mountain complexes of Konjuh-Zvijezda-Tajan; e) Livanjsko field. Other areas proposed in the physical plans of both entities would serve as islands and corridors in PAN of Bosnia and Herzegovina“ (Drešković & Mirić, 2017). The main reasons for establishing PAN are sustainable tourism and the protection of biodiversity of global importance, as well as the economic development of protected areas, local communities, and the country as a whole.

5.2. PAs as (Eco)Tourism Spots

Spot (site) is a particular point, place or area, especially one that has a particular character or where something particular happens, or that is used for a particular purpose (Oxford). Protected areas are green sites and tourism spots at the same time. „Ecotourism is tourism in protected areas“ (IUCN), it is based on nature and sustainable activities:

- green exercises (walking, hiking, recreation, forest bath, „feeling the nature“);
- science and education;
- conservation and preservation;
- managed visits (small guided groups) and sustainable tourism;
- generating benefits (socio-cultural, economic, environmental).

As the foundation of sustainable development, protected areas imply controlled access, healthy activities, limited anthropogenic effects, and targeted management to preserve the natural heritage and enable other benefits (socio-cultural, economic, and ecological). Protected areas are the primary sites of ecotourism, which is the main form of sustainable tourism. “All nature-based forms of

tourism in which the main motivation of the tourists is the observation and appreciation of nature as well as the traditional cultures prevailing in natural areas" (UNWTO). "Benefits derived from ecosystems services coming from tourism and value derived from nature is estimated 17 billion EUR a year" (IUCN). PAs are recreational sites and tourist destinations, and they are also nodes of sustainable tourism in terms of legal foundation, protection regime, and management control. "Ecotourism focuses on nature but also includes rural and cultural aspects of tourism" (Košić, 2012). Protected areas, as ecotourism destinations, focus on experiencing nature; they provide activities in nature (education and research, enjoyment and recreation), conservation, and guided visits in small groups, including local participation. „Ecotourism is generally, but not exclusively organized by specialized tour operators for small groups. Service provider partners at the destinations tend to be small, locally owned businesses. It minimizes negative impacts upon the natural and socio-cultural environment“ (UNWTO). Well-planned tourism, primarily "ecotourism", brings numerous benefits for locals living near protected areas. Increasing the standard of living can be achieved with the improvement of infrastructure and telecommunications, education and training, and health care. Tourism in PAs promotes sustainable development through the valorization of local arts and crafts, culture, ambient sites and motifs, and wildlife; altogether, they generate tourism in the area. Ecotourism encourages and strengthens the local community through skill development and government support. Ecotourism infrastructure promotes local craftsmanship to increase local income and employment. Tourism can be a mechanism for health benefits, social infrastructure, and local development in the remote management of protected areas (Leung et al., 2015). „Ecotourism supports the maintenance of natural areas which are used as ecotourism attractions by:

- Generating economic benefits for host communities, organizations and authorities managing natural areas with conservation purposes;
- Providing alternative employment and income opportunities for local communities;
- Increasing awareness towards the conservation of natural and cultural assets, both among locals and tourists“ (The British Ecotourism Market, UNWTO, 2002).

The current efforts of the developed world and international organizations to increase the percentage of protected territory up to 30%, clearly reflect the positive development tendencies of the world's ecotourism, which is stated in the literature to be the fastest growing form in the tourism industry, because protected areas serve as the home to the realization of numerous sustainable activities, and selective forms of tourism: photo safari; bird watching; animal observation; rafting; paragliding; cycling; skiing; riding; recreation and wellness; hiking; mountaineering; educational tours; forest meditation; volunteering; ecotourism; natural tourism; religious tourism; geotourism; rural tourism; cultural tourism; health tourism; scientific tourism, etc.

Protected areas in Bosnia and Herzegovina are funded through regular budget funds as well as private contributions. Entrance and various fees, the provision of tourist services, and the sale of wood mass after sanitary felling, generate revenue (Report-Regional Overview, 2021). Direct (e.g. tickets, transport, food and drink, etc.) and indirect tourist consumption (e.g. accommodation and infrastructure buildings, etc.) are important sources of income as well. According to Hrelja (2022), despite being "threatened" by the dynamic growth of tourism and congestion, Bosnia and Herzegovina's national parks have a high degree of preserved natural vegetation cover, i.e. „high“ and „very high“ forest area ranging from 75 to over 90%; they also have high creditworthiness for socioeconomic valorization (tourism, agriculture, forestry, and construction), with the participation of the „most valuable“ and „very valuable“ terrain in the total structure about 16-18%. Thus, national parks in Bosnia are perfect spots for sustainable tourism and green activities.

According to the data of several market research centers (*Grand View Research; MMR; Million Insights*), the global expansion of ecotourism has the following characteristics:

- The global ecotourism market has impressive value USD 176.03 billion (2020) and is expected to expand at a compound annual growth rate of 10.3% from 2021 to 2028.;
- Growing travelers' interest in primate ecology has amplified the market growth;
- The rising popularity of immersive and solo trips, and outdoor recreational activities in PAs;
- Wildlife tourism held the largest share of more than 33.0% in 2020 and is expected to witness the fastest growth from 2021 to 2028.;
- Europe has the largest ecotourism market (Iceland, the Netherlands, Sweden, Denmark, France, Germany- the major countries driving the market for ecotourism);
- The survey results from 91 countries, including Bosnia & Herzegovina, confirmed the growing importance of ecotourism, with 95% positive responses: „ecotourism growing“ (1-5%) and „growing fast“ (5+%)“ (The International Ecotourism Society).

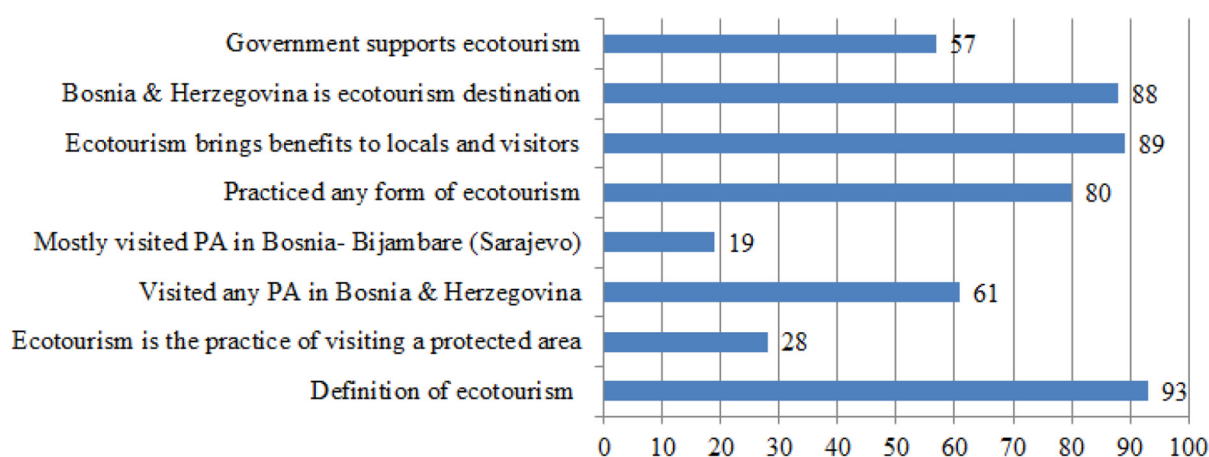


Figure 5. The survey results from Bosnia & Herzegovina – ecotourism research (%)

Source: Žunić, 2022

The survey results about ecotourism in Bosnia and Herzegovina further confirmed the awareness and need for ecotourism in Bosnia and Herzegovina (*dmtn. responses*). Bosnia and Herzegovina is regarded as an ecotourism destination, its residents are practicing ecotourism forms and activities, and they have already visited some PA in the country.

Both tourism and ecotourism in Bosnia and Herzegovina have a positive trend, as the country had “positive tourism growth rate for the period of 2014-2018., a significant number of arrivals (dmnt. from SE Europe, Turkey, UAE, etc.), the longest overnight stays of Arabian tourists from Middle East (Kuwait, Qatar, UAE), including Malta and Ireland” (Žunić, 2022).

Protected areas in BiH are strictly supervised as an official node of nature protection, and their management is governed by spatial planning documentation and other legislation. The entrance fee system governs access, while infrastructure includes connecting roads, pedestrian paths, and specific modes of transportation (e.g., *Trebević cable car*). There are marked trails and educational infoboards on the protected sites, while certain activities (e.g., barbecues) are prohibited depending on the management category. Organized visits (tour operators, schools) are conducted for groups of 5-30 people on agreed-upon dates, whereas individual visits are subject to the day use visitor access; it is shorter in winter due to the earlier sunset and the "awakening" of wildlife. Summer is the busiest season for tourists, with visitors staying for an average of 3-5 hours,

demonstrating Bosnian PAs' tourism importance. „*Same-day / day visitors* spend at least 3 hours away from home outside their usual environment for general leisure, recreational and social purposes but not staying away overnight, while even *leisure day visitors*, who spend less than 3 hours in a certain locality, also contribute to the local tourism economy“ (UNWTO; Office for National Statistics, UK). According to available statistics for certain protected areas in BiH (Internal Archive of FBiH PAs; business portal "Novosti Plus", and other cited sources), the number of visitors is increasing, as are tourist visits to the country. However, there is no networked monitoring or statistical transparency of protected area visits, and records are primarily limited to the number of tickets sold or parking utilization. To illustrate, the following indicators of tourist growth in selected Bosnian PAs show a positive trend in tourism growth and importance (except NP Kozara, RS):

Table 2. The statistical indicators of tourist growth in selected PAs, BiH (N/D for all)

Name & category of PA	Year	Visitors
NP Una (IUCN-II)	2018	100.000
	2019 (inc.)	119.000
	2022	128.000
NP Kozara (IUCN-II)	2018	130.000
	2019. (dec.)	122.000
	2021	99.800
Bijambare (IUCN-V)	2018	64.645
	2019 (inc.)	68.789
	2022 (<i>Jan-Nov</i>)	56.900
Spring of Bosnia (IUCN-III); nucleus	2018	188.689
	2019 (inc.)	275.089
	2022 (<i>Jan-Oct.</i>)	267.651
Trebević (IUCN-V)	2019.	1.000.000
	2022.	1.500.000

Source: Author

Mostly visited and most popular protected areas in Bosnia and Herzegovina are those in Sarajevo (*the capital*), led by the protected landscape of Trebević and the natural monument Spring of Bosnia. „Natural attractions in the vicinity of Sarajevo make an important addition to the basic tourist image of the city, which primarily refers to the mountains and the protected areas“ (Mirić et al., 2017).

6. FUTURE RESEARCH DIRECTION (FRD)

To ensure the most effective mode of managing visits, FRD should be oriented toward successful visitor monitoring in EU PAs and the feasibility of its implementation in BiH PAs. In the future, researchers should collaborate with PA agencies and other relevant offices to collect and present tourist statistics data for all PAs. Because there is no integrated visitor monitoring at protected sites, alternative methods could be used to complete the picture (e.g., visitor counting and surveys).

7. CONCLUSION

Even though Bosnia and Herzegovina hasn't achieved its goal to protect about 16% of its territory, and the recent percentage is four times lower than what was planned, there's been a positive trend in the growth of PAs lately. *Sarajevo*, the country's most visited destination, is an example of the growing number of PAs as their importance in tourism is recognized. The fact is

that Bosnia is developing as a tourism destination with a significant tourism growth rate, which is followed by the popularization of PAs, especially because demand for ecotourism is growing too. As Bosnia tends to implement the international agreements' objectives in the field of nature and environment protection, governments at all levels will have to cooperate more efficiently. Furthermore, visitor management in PAs should be a priority for implementation, starting with Sarajevo PAs, as it's the capital and most popular destination. The scientific foundation for the future development of PAs must be strengthened and supported through projects and other relevant documentation in the field of spatial and tourism planning. Once effective visitor monitoring in PAs is established, transparent statistics will explore tourism benefits. Thus it will stimulate the development of new protected areas, but it will also enable their more sustainable management.

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Glass Waste Management in the Republic of Croatia: Current Situation and Trends

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Abstract: This paper presents the current situation and trends in the waste management system in the Republic of Croatia. The aim of the paper is to identify the main problems in the waste management system based on the analysis of secondary data, and thereby create a basis for empirical research in this area. The paper first discusses the regulatory framework for glass waste management, followed by an analysis of the current situation in the collection and recycling of municipal waste and glass waste packaging in Croatia. The practicality of applying the deposit system is discussed through the analysis of drivers and obstacles in the example of the deposit system for beer bottles. The results show a growing trend in the amount of all waste packaging collected. However, the current situation in the waste management system in Croatia is still not at a satisfactory level, especially regarding the disposal of glass packaging.

1. INTRODUCTION

It is becoming more and more obvious that economic and social development is dependent on sustainable development. *Business as usual* leads to a gradual economic decline, and thus there is a need to focus on long-term solutions such as business following sustainable development (Lončar, 2019). According to the document *Towards a sustainable Europe by 2030*, sustainable development is defined as „the development that meets the needs of present generations without compromising the ability of future generations to meet their needs“ (European Commission, 2019, p. 6). Cifrić (2000) emphasizes that sustainable development can be seen from different aspects and highlights three global development perspectives: the perspective of competition (a development that continues), the perspective of astronauts (global management of the Earth as a system and ecological consequences), the perspective of the homeland (respect for traditions, belief systems and biological diversity at the regional and local level). With such an understanding, sustainable development is considered (1) from the level of competition in terms of the actions of companies under sustainable development to achieve competitiveness, (2) from the level of society as part of the creation of a globally cleaner Earth as a place to live, and (3) from the level that refers to the operation of regional and local areas in the context of adopting acceptable environmental protection policies and measures.

Following the policies of the European Union, the promotion of sustainable development should take place in three key directions: smart growth (development based on knowledge and innovation), sustainable growth (stimulation of greater resource efficiency) and inclusive growth (stimulation of an economy with high employment) (Lončar, 2019). However, although some guidelines are stated, the companies themselves still do not have a clear vision of how to implement sustainable development in their operations (Cifrić, 2000). New EU regulations on waste were

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adopted in 2018, and the new goal by 2030 refers to the achievement of a minimum reuse or recycling rate of municipal waste of 60% and packaging waste of 70%. Also, by 2035, the share of waste disposed of in landfills should be reduced to less than 10% (European Commission, 2019, p. 103). When the focus is placed on the process of separation and recycling of glass packaging in Croatia, it is possible to see a large number of problematic situations related to the current regulatory framework and the existing practice of implementing these processes.

This paper aims to examine the current situation in the waste management system and trends related to the amount of collected waste packaging in Croatia, to identify the key problems that affect the observed trends and thus pave the way for further empirical research related to the waste management system. In the first part of the paper, the regulatory framework of glass waste management in the European Union and Croatia is explained, followed by a more detailed analysis of the current situation in the collection and recycling of municipal waste and glass packaging, including problems in that process. The practicality of applying the deposit system was investigated by analyzing drivers and obstacles in the example of the deposit system for beer bottles. In the conclusion, the key points of the work are highlighted and practical implications and recommendations for future research are stated.

2. REGULATORY FRAMEWORK FOR GLASS WASTE MANAGEMENT IN THE EUROPEAN UNION AND CROATIA

According to the *Ordinance on Packaging and Waste Packaging* from 2015, the packaging material is „every material from which packaging is produced, such as: glass, plastic, paper, cardboard, wood, metal, multi-layer (composite) mixed materials and other materials“ (Narodne novine, 2015). According to the currently valid provision from the *Ordinance on Amendments to the Ordinance on Packaging and Waste Packaging* from 2020, in the management of waste packaging resulting from the placing of packaging or products in packaging on the market in the Republic of Croatia, the following national goals stand out:

1. „Separately collect and recover, materially or energetically, a minimum of 60% of the total mass of waste packaging generated on the territory of the Republic of Croatia“
2. „Recycle at least 55% and up to a maximum of 80% of the total mass of waste packaging intended for material recovery“
3. „Achieve minimum recycling rates of packaging materials contained in waste packaging, namely: 60% of mass for glass, 60% of mass for paper and cardboard, 50% of mass for metals, 22.5% of mass for plastic (counting only the material that was recycled back in plastic), 5% of the mass for wood“ (Narodne novine, 2015).

To ensure the harmonization of measures at the national level with the current regulations of the European Union and thereby enable a faster transition to the circular economy, the Republic of Croatia adopted two action plans: *Closing the loop – An EU action plan for the Circular Economy* in 2015 and *A new Circular Economy Action Plan for a cleaner and more competitive Europe* in 2020. However, as the legislation on waste was revised in 2018, as a result, four new directives on waste appeared, which defined new, higher goals in terms of waste separation and recycling with a tendency to reduce waste by 2035. More precisely, the new goal by 2035 is tied to increasing waste separation and recycling to 65% and reducing waste disposal to 10% (Narodne novine, 2022).

Directive (EU) 2018/851 envisages achieving the goal of reusing and recycling at least 50% of the total weight of waste materials such as paper, metal, plastic and glass from households by

2020. Following the EU target, a linear increase in the percentage amount of recycling compared to the current five-year period by 5% is predicted. More precisely, by 2025 the minimum percentage of reuse and recycling by weight of waste materials should be 55%, by 2030 it should be at least 60%, and by 2035 at least 65% (Narodne novine, 2022).

Accompanying measures defined by the Waste Management Plan of the Republic of Croatia for the period 2017 – 2022 include the following items:

- M 1.2.1. Procurement of equipment, vehicles and vessels for separate collection of paper, cardboard, metal, plastic, glass and textiles
- M 1.2.2. Construction of a facility for sorting separately collected paper, cardboard, metal, glass, plastic, etc. (sorting plant) (Decision on implementation was adopted)
- M 1.2.3. Construction of recycling yards (Decision on implementation was adopted)
- M 1.2.4. Introduction of charging for the collection and processing of mixed and biodegradable municipal waste by quantity (Decision on implementation was adopted)
- M 1.2.5. Strengthening the market for waste intended for separation
- M 1.2.6. Construction of recycling facilities (Narodne novine, 2022).

Regarding Directive 2018/852 (EU), sub-goal 2.3 reads: *Improve the waste packaging management system*, which for the glass packaging category implies reaching the target glass recycling rate of 60% by weight. No later than 31st December 2025, the stated recycling rate should be 70% by weight of glass, while by December 31, 2030 at the latest, 75% by weight of the collected glass had to be recycled. In accordance with the above, the following measure was defined: M 2.3.1. *Improvement and analysis of the existing waste packaging management system*, for which the Decision on Implementation was previously adopted (Narodne novine, 2022).

3. CURRENT SITUATION IN THE PROCESS OF COLLECTION AND RECYCLING OF MUNICIPAL WASTE AND GLASS PACKAGING IN CROATIA

To be able to understand what the term municipal waste includes, below is its definition: “Municipal waste is mixed municipal waste and separately collected waste from households, including paper and cardboard, glass, metal, plastic, bio-waste, wood, textiles, packaging, waste electrical and electronic equipment, waste batteries and accumulators and bulky waste, including mattresses and furniture and mixed municipal waste and separately collected waste from other sources, if this waste is similar in nature and composition to household waste” (Narodne novine, 2022).

Thus, the term municipal waste includes two categories of waste: mixed municipal waste that cannot be sorted and that waste that is collected separately in the form of waste classification depending on the type of waste (plastic, paper, etc.). Observing the *Regulation on Municipal Waste Management*, which entered into force in 2017, and was supplemented by the *Regulation on Amendments to the Regulation on Municipal Waste Management* in 2019, it is clearly emphasized that when collecting mixed municipal waste, it is necessary to ensure separate collection and recycling of waste paper, waste metal, waste plastic and waste glass as much as possible to reduce the amount of waste for disposal. Accordingly, for the collection of waste glass, appropriate containers must be provided on the public surface (Narodne novine, 2017).

According to publicly available, official data from the Ministry of Economy and Sustainable Development, within 20 years, starting in 1995, the largest amount of collected municipal waste in tons was recorded in 2019 (1,811,617 tons, that is, 444 kilograms per inhabitant). A year later,

26 kg/inhabitant less municipal waste was collected, more precisely, a total of 1,692,966 tons were collected. Comparing the above with the year 1995, when the municipal waste collection system was not so developed, only 212 kg/inhabitant, that is 978,542 tons of municipal waste, was collected (Table 1). In the following years, a positive trend and awareness of the authorities in the form of environmental protection can be observed, but the dose of coercion originating from the directives of the European Union should not be ignored (MINGOR, 2020).

Table 1. Collected municipal waste in Croatia, 1995-2020

Year	Municipal waste (tons)	Increase/decrease compared to the previous year (tons)	Increase/decrease compared to the previous year (%)
1995	978,542	-	-
1997	1,015,000	36,458	4%
2000	1,172,534	157,534	16%
2004	1,310,643	138,109	12%
2005	1,449,381	138,738	11%
2006	1,654,105	204,724	14%
2007	1,718,697	64,592	4%
2008	1,788,311	69,614	4%
2009	1,743,211	-45,100	-3%
2010	1,629,915	-113,296	-6%
2011	1,645,295	15,380	1%
2012	1,670,005	24,710	2%
2013	1,720,758	50,753	3%
2014	1,637,371	-83,387	-5%
2015	1,653,919	16,548	1%
2016	1,679,765	25,846	2%
2017	1,716,441	36,676	2%
2018	1,768,411	51,970	3%
2019	1,811,617	43,206	2%
2020	1,692,966	-118,651	-7%

Source: prepared by the authors according to MINGOR, 2020

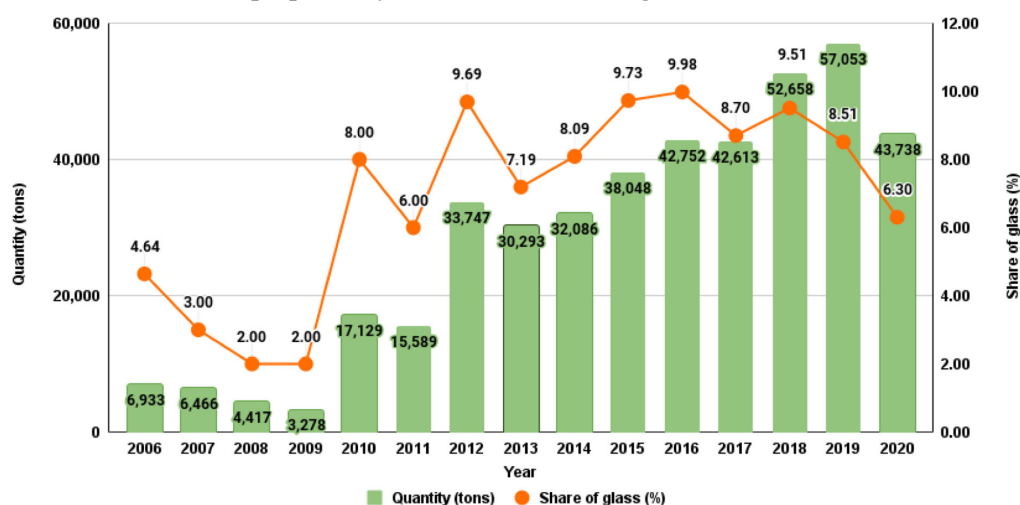
Furthermore, in the period from 2010 to 2020, the amount of separately collected municipal waste has almost tripled, which consequently indicates a positive trend in consumer awareness over the years (Table 2). That is, a tendency to increase the amount of collected municipal waste was observed, which reached its peak in 2020, when the rate of the separate collection was 41% (694,159 tons), thus compared to 2010 it increased by 27% (227,651 tons), and compared to 2019 by 4% (670,769 tons). However, this type of waste cannot be completely recycled. Namely, in 2020, the recycling rate of separately collected municipal waste was 34%, so according to the *Law on Sustainable Waste Management*, the goal of 50% for the mentioned year was not achieved. However, it can be observed that recycling rates are increasing from year to year, which is best evidenced by the recycling rate of 4% recorded in 2010 (MINGOR, 2020).

After an insight into the general state of waste collection, it is necessary to investigate the proportion of glass in such collected waste, which is shown in Figure 1. It can be seen that the proportion of glass in separately collected waste varies over the years. This alone gives the impression that, unlike the constant growth of separately collected municipal waste, there is no such trend for glass packaging (MINGOR, 2020).

Table 2. Quantities of separately collected municipal waste in Croatia, 2010-2020

Year	Separate collection of municipal waste (tons)	Separate waste collection rate (%)	Increase/decrease compared to the previous year	Recycling rate (%)
2010	227,651	14%	-	4%
2011	268,053	16%	2	8%
2012	382,078	23%	7	15%
2013	421,182	24%	1	15%
2014	396,594	24%	0	17%
2015	391,075	24%	0	18%
2016	428,466	26%	2	21%
2017	488,209	28%	2	24%
2018	553,791	31%	3	25%
2019	670,769	37%	6	30%
2020	694,159	41%	4	34%

Source: prepared by the authors according to MINGOR, 2020

**Figure 1.** Quantity and share of glass waste in separately collected municipal solid waste, 2006-2020

Source: prepared by the authors according to MINGOR, 2020

It is interesting to note that the amount of glass in separately collected municipal waste varies from a minimum of 2% in 2008 and 2009 to 9.98% in 2016. The biggest jump in the share of glass in separately collected municipal waste occurred at the turn of 2009 to 2010 (from 2% to 8%). This can partly be explained by the fact that in previous years, glass packaging was generally separated very poorly, so the amount of collected glass was only 3,278 tons. After 2010, when citizens began to collect glass packaging more actively, considerable amounts of glass packaging were collected, which is why there was such a large percentage change. For the last available year 2020, the stated rate was 6.30% (or 43,738 tons) (MINGOR, 2020).

According to the author's opinion, when looking at the total amount of glass in separately collected municipal waste, it is a very low level of share, which could be significantly increased by investing in the municipal waste management system. According to the data of the Ministry of Economy and Sustainable Development, in the period from 2015 to 2020, there was a growing trend in the amount of all waste packaging collected. In the mentioned process, on average, glass packaging waste participated with a share of as much as 27%. Looking at the goal set

in 2008 (achieving a glass recycling rate of 60%) and the realized recycling rates for the period from 2015 to 2020, it can be seen that the rates for glass were very close to the goal in 2016, 2017, 2019 and 2020. Figure 2 shows the corresponding visualization of the glass recycling rate, where the recycling rates that did not meet the goal are marked in red (MINGOR, 2020).

It can be seen that these are oscillatory movements over the years, and the goal was achieved in 2015 and 2018. Unfortunately, the glass recycling rate decreased in 2019 and 2020 compared to 2018, when it dropped from 61% to only 51% in 2019, after which it increased only slightly to 54% in 2020. The highest glass recycling rate was recorded in 2015, when it amounted to 65%, but already in 2016 it was significantly reduced and reached 56%, i.e. 57% in 2017 (Narodne novine, 2022).

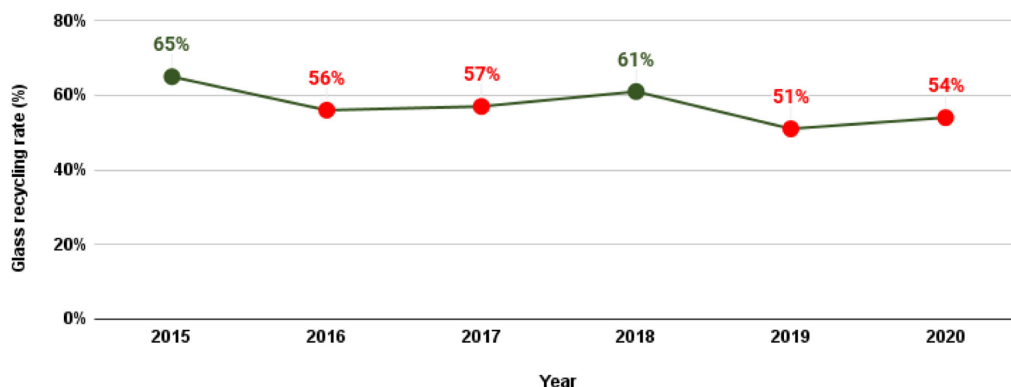


Figure 2. Glass waste recycling rate in Croatia, 2015-2020

Source: prepared by the authors according to MINGOR, 2020

4. PROBLEMS IN THE PROCESS OF COLLECTING AND RECYCLING MUNICIPAL WASTE AND GLASS PACKAGING IN THE REPUBLIC OF CROATIA

One of the problems in the process of municipal waste collection and recycling in the Republic of Croatia is the fact that even in 2020, the public municipal waste collection service did not manage to cover all parts of the Republic of Croatia. Namely, in 2020, a total of 530 local self-government units had secured conditions for the separate collection of at least one of the following four fractions of municipal waste: paper/cardboard, plastic, glass and metal. More precisely, it is a share of 95% in relation to a total of 555 local self-government units, i.e. the conditions were ensured for 124 cities (a share of 97% of a total of 127 cities) and 406 municipalities (a share of 95% of a total of 428 municipalities). A positive point can be seen in the fact that a total of 427 local self-government units (a share of 77% of a total of 555 local self-government units) in 2020 ensured the conditions for the separate collection of all four mentioned fractions of municipal waste. More precisely, for 25 (5%) local self-government units, consisting of 3 cities and 22 municipalities, the state failed to ensure adequate separate collection of any of the four mentioned fractions of municipal waste (Narodne novine, 2022). Observing the above through the sphere of glass packaging, it is observed that 513 local self-government units managed to ensure separate collection of glass, which gives a share of 92% of local self-government units (Narodne novine, 2022).

The possibility of achieving the goals set in the EU legislative framework is questionable since the Republic of Croatia currently does not have sufficient infrastructure for the realization of the stated goals. First of all, it is necessary to acquire equipment and vehicles for separate waste collection. Also, work should continue on the construction of facilities for sorting separately collected waste and ensure a greater number of recycling yards, along with the need to build

facilities for recycling recyclable waste. Due to all of the above, there were minor changes in the national goals, i.e. in the end, the goal for the separate collection of 60% of the mass of produced municipal waste (primarily paper, glass, plastic, metal, biowaste, etc.) was changed so that it was set at the level of 52% (Narodne novine, 2022).

In addition to the widespread disposal of glass packaging in green containers, one of the lesser-known possibilities offered in more developed cities in the Republic of Croatia is the possibility of disposing of glass packaging in recycling yards. Figure 3 clearly shows the linear growth of the number of active recycling yards, which amounted to 186 in 2020. This is a significant increase compared to 2015 when only 52 recycling yards were active. Following the mentioned, linear growth of the amount of municipal waste collected through recycling yards is also seen, with the peak reaching 2020 (60,146 tons). However, this is still too little amount of waste collected in recycling yards. As the managers of the recycling yards point out, the aforementioned was adversely affected by the coronavirus pandemic, which successfully merged with citizens' lack of interest in separating any type of municipal waste (MINGOR, 2020).

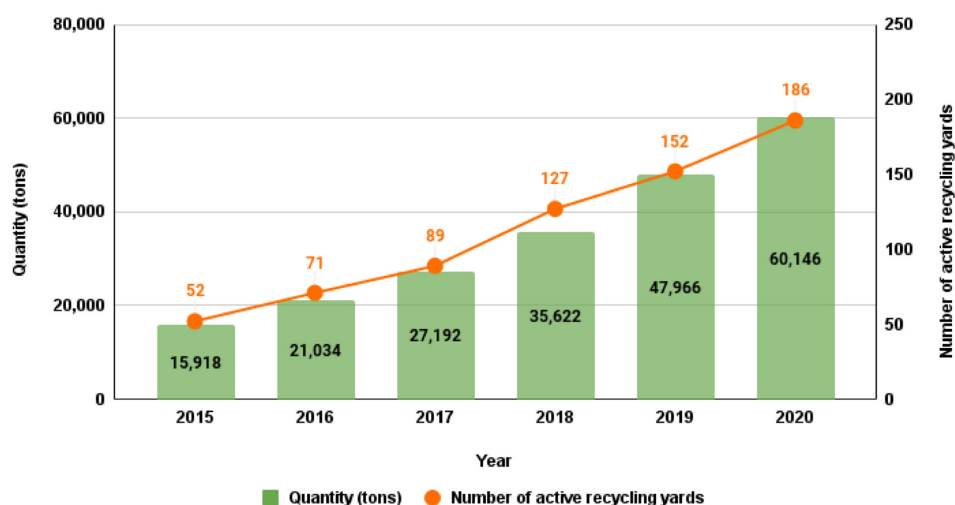


Figure 3. Amount of municipal waste collected through recycling yards (tons) and number of active recycling yards in Croatia, 2015-2020

Source: prepared by the authors according to MINGOR, 2020

5. DRIVERS AND BARRIERS ON THE EXAMPLE OF A DEPOSIT SYSTEM FOR BEER BOTTLES

In order to determine the efficiency of the deposit system, the deposit system for beer glass bottles that achieve multiple use will be presented below. Platt and Rowe (2002, p. 8) analyzed the available literature and came to the conclusion that the amount of water needed to wash refillable glass bottles is significantly less than the amount of water used to produce new one-way glass bottles for a given amount of drink. For this reason, product reuse, along with reducing the negative impact on the environment, potentially brings significant cost savings. With reusable products, consumers often have a perception of repulsion or disgust towards such products because they are concerned about cleanliness or suspect a lack of quality. It is emphasized that refilling systems use advanced technologies that make it possible to thoroughly inspect the bottles after they have been washed in order to detect those micro-organic contaminants (Platt & Rowe, 2002, p. 3). In view of all the above, customers should not be concerned about the cleanliness or lack of quality of the products being reused. Furthermore, it is a fact that glass recycling is less energy intensive than the

production of new glass, with the beer bottle itself being among the highest quality glasses (Riddell, 2013). So, the main reason why the refund system was started for beer bottles is reflected in the quality of the glass of the beer bottle, that is, the relatively high costs of reproducing that glass.

In Croatia, the deposit system for packaging came to life in January 2006, resulting in an extremely high rate of collection of packaging waste in the return fee system. This is supported by the fact that, according to the data of the Croatian Agency for the Environment and Nature, the collection rates for PET packaging are 96%, glass 82% and Al/Fe 85% (Petrović, 2018). From the mentioned data, it can be seen that it is a successful system that has truly resulted in a high rate of packaging waste collection, and therefore a greater concern for the environment. The packaging deposit system refers to the buyer returning the empty packaging to the supplier for a financial incentive and is most commonly used for soft drink bottles and beer bottles (Lofthouse & Bhamra, 2006). What should be mentioned is that this approach, as well as refilling empty bottles, has often been used in the past. For example, in Finland, 73% of beer bottles can be refilled, while in Denmark, the Netherlands and Prince Edward Island in Canada, this share is even 100% (Platt & Rowe, 2002, p. 2). Given that the deposit system for packaging has been functioning successfully for years, the question arises as to why the same system has not been implemented for other glass packaging intended for the storage of food products.

In the context of reducing the burden on traders in the application of the deposit system, Lofthouse and Bhamra (2006) suggest the use of reverse vending machines. These are devices that accept empty beverage bottles and return money to the user, which makes the bottle return process easier for retailers, but also the users themselves. In addition to bottles, the devices can also be used for other types of packaging. In some stores, when using reverse vending machines, customers can even donate their returns to a favorite charity (Platt & Rowe, 2002). It is indeed an interesting attempt to automate the return system that requires minimal burden on store employees. However, the possibility of using such machines has a limitation, which is reflected in their price, that is, the possibility of purchasing the device for each store.

One radical idea that could force manufacturers to apply the idea of reuse is the introduction of a quota of products designed to be reusable. In Croatia, producers and importers of beverages are obliged to pay a fee for waste management to the Environmental Protection and Energy Efficiency Fund according to the weight of the packaging placed on the market. In addition, the Fund is paid an additional fee per product unit and a return fee of HRK 0.50 (Petrović, 2018). The Environmental Protection and Energy Efficiency Fund thus represents the main extra-budgetary institution from which programs and projects related to nature protection, environment, energy efficiency and the development of renewable resources are financed. The sources of financing are mostly represented by eco-taxes that are charged to polluters and users of natural resources (Matešić, 2020, p. 171). The Environmental Protection and Energy Efficiency Fund acts as an intermediary in the entire system, organizes the entire system and contracts for the collection and recovery of packaging waste (Petrović, 2018).

6. CONCLUSION

Numerous authors dealt with the topic of waste sorting and recycling, with most of them emphasizing that a developed infrastructure for recycling, as well as timely education, are key to increasing the more frequent separation of packaging. These two indicators are perceived as key problems within the waste management system in the Republic of Croatia. Consequently,

the current situation indicates that the waste management system cannot achieve the set goals. However, it should be noted that the results indicate a positive growth trend in the amount of separately collected municipal waste in the period from 2010 to 2020. However, glass packaging does not record a constantly growing trend in a separate collection. The deposit system for beer bottles was analyzed as an example of good practice. This system could potentially be applied to all food glass packaging, and it is opportune to examine the economic, social and other effects of its implementation.

The contribution of the work is manifested in gaining insight into the current situation and trends in the waste management system in Croatia. An insight into the state and current problems related to waste management can serve as a basis for empirical research in the area. In this context, it is proposed to carry out a study aimed at examining the effects of extending the deposit system to all types of glass food packaging. Regarding the practical implications, it is suggested to improve the existing infrastructure in the field of waste management and implement educational programs on environmental protection, primarily due to the perceived ignorance of Croatian citizens about the concept of recycling yards.

The limitations of the paper are seen in the absence of empirical research that could explore the topic in more detail. Therefore, as a recommendation for future research, it is pointed out the possibility of conducting empirical research related to the examination of citizens' attitudes and opinions about the waste management system in Croatia, as well as the opinions of experts to gain a deeper insight into the issue.

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A Methodological Framework Enhancing Energy Efficiency Investments in Buildings

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Abstract: *The energy efficiency market is fragmented over many types of projects and contract types, small portfolios and many methods for assessing project risk, which disrupts market growth. These current insufficient trends observed in the renovation rates of buildings reveal the urgent need for action. To address this, appropriate implementation of energy efficiency measures which are adopted by the majority of final energy users is a must, but which are the proper initiatives required to further assist the acceleration of the EE projects' successful implementation? The aim of this paper is to present the methodological framework leading to the creation of an effective energy efficiency marketplace, bringing together energy services and sustainable finance techniques, with the ultimate purpose of accelerating building renovation rates. The methodology is focused on the aggregation of energy projects to packaged solutions, so as to transform the complex set of decision-making actions for building renovation into a user-friendly and single-entry ICT-enabled solution.*

1. INTRODUCTION

Energy efficiency is fundamental for the cost-effective transition toward a decarbonised and reliable energy system (Chen et al., 2018). The decarbonisation of the buildings sector is vital to deliver on the European Union's (EU) 2030 and 2050 climate and energy objectives. Buildings are responsible for 40% of total energy consumption and 36% of energy-related greenhouse gas emissions in Europe, yet the weighted annual energy renovation rate at the EU level is only around 1% (EU, 2022; Lin & Chen, 2022).

Energy efficiency investments in buildings have a direct effect on reducing energy consumption towards achieving the EU energy and climate objectives for 2030 and 2050 while also driving economic growth (Karakosta et al., 2021). To achieve efficient energy use, updates in industry processes, building stock and other sectors are needed, and, thus, capital should be oriented to energy efficiency investments (Geske, 2022). In parallel, sustainable design of the building energy allocation is vital for human well-being and ecosystem health, which means that under the carbon emission and energy targets that the EU has set, the building sector needs to improve building energy efficiency and promote related investments (Zitars et al., 2021).

Furthermore, the current insufficient trends observed in the renovation rates of buildings, reveal the urgent need for action. To address this, the appropriate implementation of energy efficiency measures is considered essential. Towards this direction, a combination of public and private funding through innovative financing instruments is required to overcome current barriers that prevent the mobilization of necessary investments.

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In the above context, there is a definite need for leveraging private funds into energy efficiency and this shall be driven by capturing the total value brought by interventions aiming primarily at increasing the energy performance of the building stock. One way to achieve this is to make energy efficiency in buildings a marketplace where market actors can interact by closing deals in a comfortable, predictable, and risk-free environment.

This paper aims to present the methodological framework leading to the creation of an effective energy efficiency marketplace, bringing together energy services and sustainable finance techniques, with the ultimate purpose of accelerating building renovation rates. The methodology is focused on the aggregation of energy projects to packaged solutions, so as to transform the complex set of decision-making actions for building renovation into a user-friendly and single-entry ICT-enabled solution.

2. THE MARATHON TO ENERGY EFFICIENCY

The energy efficiency market is fragmented over many types of projects and contract types, small portfolios and many methods for assessing project risk, which disrupts market growth. Energy efficiency investments are driven by a variety of stakeholders with widely diverse problems and interests. Most often, split incentives, lack of appropriate risk identification and sharing, fragmentation of the market, lack of investment standardization and other hurdles put at risk the real implementation of energy efficiency projects.

On the other hand, the need for standardised tools that may boost investments based on stakeholders' perceptions has been positively assessed by various European Commission (EC) services and is addressed in various ways. One of them is the implementation of the Sustainable Energy Investment Forums (SEIFs), an initiative that was launched by the EC in 2017. Until now, more than 40 events in 25 Member States were organised to facilitate dialogue between relevant stakeholders for activating private-sector investments in sustainable energy, while the overall goal is to enhance access to finance for energy efficiency projects. In addition, the SEIFs support through constructive dialogue, replication and scale-up of best practices have been recognized in various European countries.

There are also several EU-funded projects working towards the enhancement of the investments of energy efficiency projects at the regional level (Loureiro et al., 2020), using the results of the SEIFs. Such an example is the European SMAFIN project which is setting up the prosperous ground to connect smart financing with energy-efficient projects in 4 Balkan countries (Bulgaria, Croatia, Greece and Romania) and to create a complete roundtable discussion methodology (SMAFIN, 2020). Though regional roundtables as an anchor point and in interaction with the national roundtables the project aims to define the national supportive frameworks for enhancing the increase of financing for energy efficiency projects.

Furthermore, the Triple-A project, concluded in May 2022, provides the Triple-A Toolbox, an online instrument for risk assessment and benchmarking of energy efficiency projects, tested and evaluated by more than 100 investors and financial institutions, which paves the way for identifying and financing the most promising ones, called "Triple-A" investments (Triple-A, 2022). The Triple-A approach behind the Tools is in line with the EU Taxonomy Guidelines and utilizes financial indicators and Sustainable Development Goals (SDG) criteria, while it has been validated in eight (8) EU case study countries (Mexis et al., 2021). Moreover, Triple-A

offers the Triple-A Web-based Database on energy efficiency financing in order to provide critical aspects and data to relevant stakeholders, such as risks, mitigation strategies and financing models and instruments.

Moreover, MATRYCS an ongoing H2020 project, launched in September 2020, aims at addressing the emerging challenges in big data management for buildings with an open holistic solution. MATRYCS provides a cloud-based fully scalable and interoperable data management solution for data-driven services to enable the adoption of business models for the building sector. The combined AI and IoT infrastructure management Toolbox constitutes the catalyst for conceptualizing and generating building services for enhanced reliability and reduced risks of EE investments (MATRYCS, 2022). More specifically, there are dedicated analytics services for energy efficiency projects in buildings focusing on renovation actions and evaluation of their performance and bankability.

In addition, many related research projects try to address issues on energy efficiency and promote investments in specific key areas. Indicative examples of H2020 research projects are analysed below.

The main goal of the QUEST project is to promote private investments and financing in sustainability and energy-efficiency projects by developing a simple toolkit that will enable financial institutions to determine relevant factors that influence risk in the design, construction and operations of energy efficiency and sustainability projects (QUEST, 2022). The RenOnBill project provides tools to address the residential sector's energy renovation financing demand and assesses and bundles investments based on a transparent methodology (RenOnBill, 2022). Moreover, the Energy Efficiency Financial Institutions Group (EEFIG) has developed the EEFIG Underwriting Toolkit to assist financial institutions in scaling up their capital deployment into energy efficiency, while also developing the EEFIG De-risking Energy Efficiency Platform (DEEP Platform, 2022), an open-source database for energy efficiency investments performance monitoring and benchmarking. It aims to help users to better understand the real risk and benefits of energy efficiency investments based on market evidence and tangible track records. Similarly, the EU-funded EN-TRACK project addresses the major challenge hindering energy efficiency investments which mainly constitutes the lack of statistical data pointing to energy and cost savings (EN-TRACK, 2022). EEnvest project's objectives are to secure investors' trust in energy efficiency actions for existing buildings by developing a combined technical-financial risk evaluation framework focused on the renovation of commercial buildings (EEnvest, 2022).

Of course, these projects are only just a few examples but there are other EC-funded initiatives dealing with different aspects of energy efficiency. The scope of this study is to build on the available outcomes derived from related recent EU projects, scaling up their outcomes, and find a way to combine best practices to provide a holistic methodology tackling all challenges deriving from all key actors' needs, mainly financiers, project developers and building managers. Therefore, based on the outcomes of these projects dealing with financing, others focus on risks, benchmarking, standardization, etc. The idea is to digitalize all existing advancements, integrate them and make energy efficiency in buildings a marketplace where market actors can interact in a predictable and risk-free environment.

There is a general lack of attractive and easily accessible financing packages for the building sector including private funds and most importantly there are inadequate decision-making

processes and access to projects and financing products. To this end, independent and transparent advisory methodologies are required to inform and assist key actors in order to prepare packaged solutions to overcome the barriers to uptake.

3. PROPOSED METHODOLOGY

One way to achieve to bring together energy services and sustainable finance, with the ultimate purpose of accelerating building renovation rates is to make energy efficiency in buildings a marketplace where market actors can interact by closing deals in a comfortable, predictable, and risk-free environment. The proposed methodology to make energy efficiency in buildings a marketplace envisages the development of an ICT platform based on three (3) major Platform stages: Fetch-Process-Deliver (Figure 1).

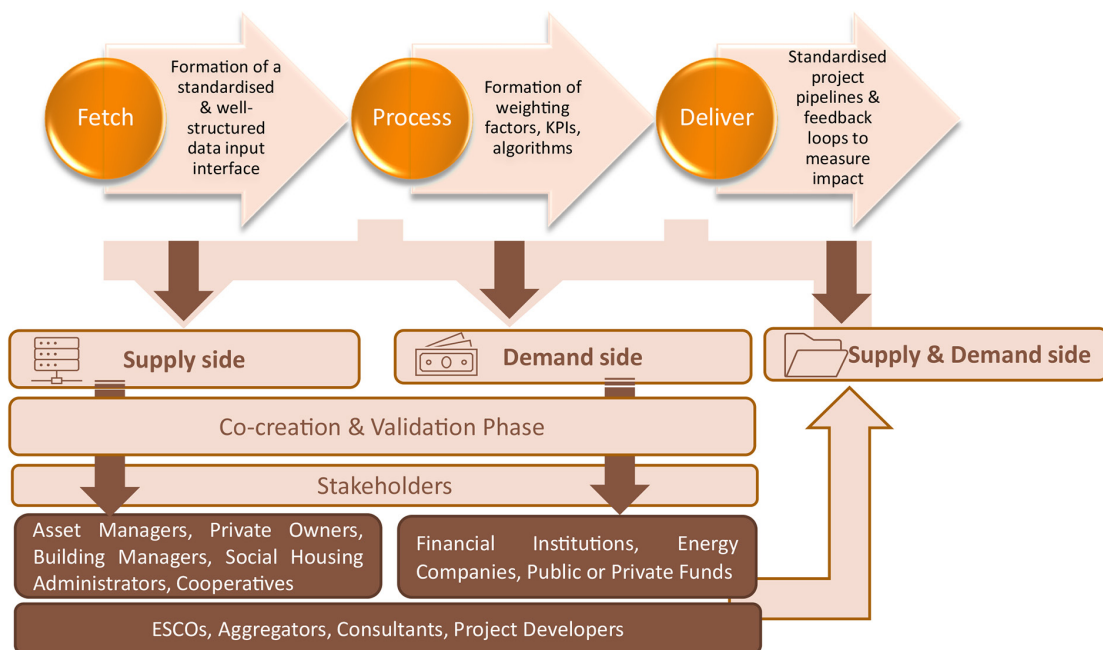


Figure 1. Methodological Concept

The core of the concept centers around the definition of the roles of the potential users of a big data for buildings platform, their relationships and requirements with the ultimate purpose of accelerating renovation rates. Based on the methodological framework the “commodity” to be traded in the market are the energy savings cash flows stemming from the energy efficiency projects.

The key categories of market actors identified in the marketplace:

- **Supply side:** Actors interested to develop energy efficiency projects for which they seek (additional) funds, hence “supplying” energy savings i.e., the “commodity”. The supply side should be able to supply energy savings by developing project pipelines that appear attractive for the financing partners to invest. These can be public or private parties with different projects and different financing access and credibility profiles (public authorities, private asset managers, private owners, social housing administrators, communities/cooperatives, etc.).
- **Demand side:** Actors interested to invest in sustainable projects for which they offer funds, hence “demanding” cash flows derived from energy savings i.e., the “commodity”. The demand side adopts a standardized approach on how potential projects are assessed in terms

of their expected return and associated risks. They may comprise energy companies with EEOs, financing partners and even public or private funds.

- The intermediaries/service providers – comprise several other actors including e.g., the aggregator, the technical consultant/validator, the ESCO, and the data services provider (big data platform provider).

Going into detail in each stage of the methodology (Figure 2), the aim of the 1st stage “Fetch” is to collect information on building renovation projects in a structured manner ensuring that key information related to the technical, commercial and risk-related aspects are properly declared by each project at the state of entering into the platform. There are various building uses by various types of ownership and administration models, so through a standardised online form the input here would be a) ownership and use information (occupancy, location, etc.), b) technical data (floor area, energy consuming equipment, benchmarks, level of automation), c) renovation measures (envelope, equipment, automation).

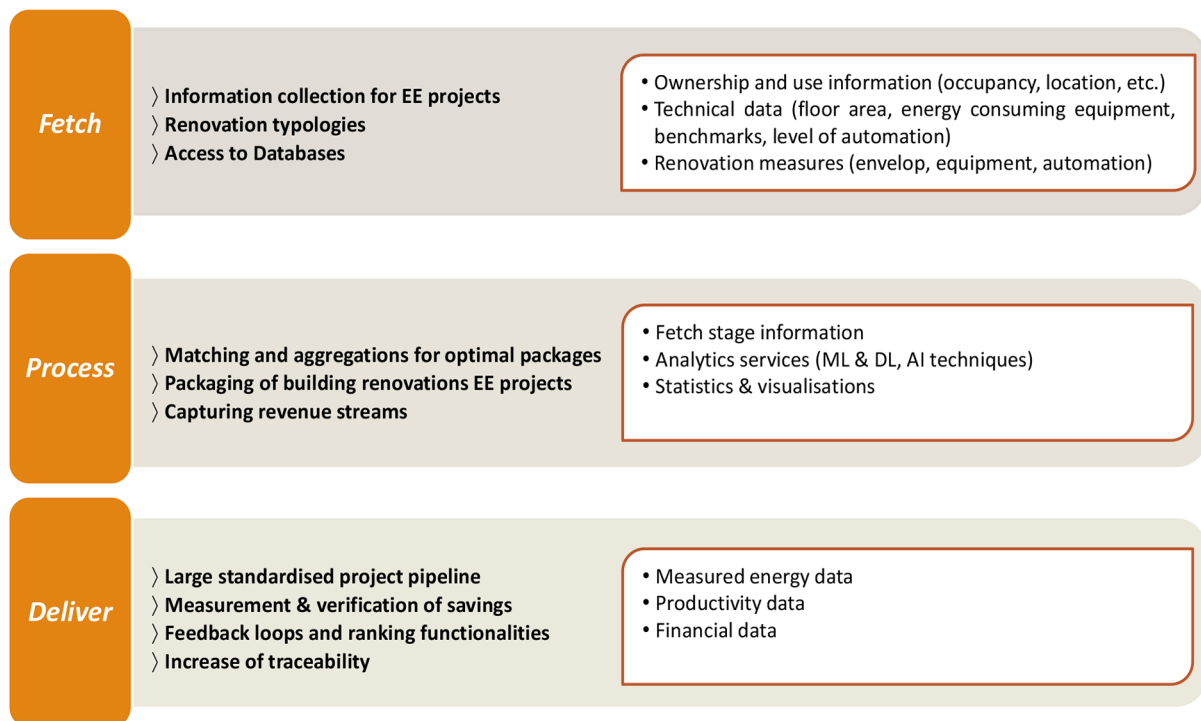


Figure 2. Methodological Stages Vision and Input Requirements

In the “Process” stage, the methodology follows the matching and aggregations. The focus is on the packaging of building renovations for appropriate financing taking also into account opportunities for capturing revenue streams beyond energy savings. The information requirements here are to use data collected through the Fetch stage and feed them into analytics services (Machine Learning, Artificial Intelligence, digital twins, etc.) and visualization tools to propose optimal renovation investment packages.

The “Deliver” stage aims to enhance the flow of “real” information on energy efficiency and energy services results and use it for delivering appropriate feedback. The more the databases are populated by data deriving from real-life renovation projects, the more their analytical functions become more robust and fine-tuned. Information requirements here are Energy, productivity and financial data deriving from the implemented projects.

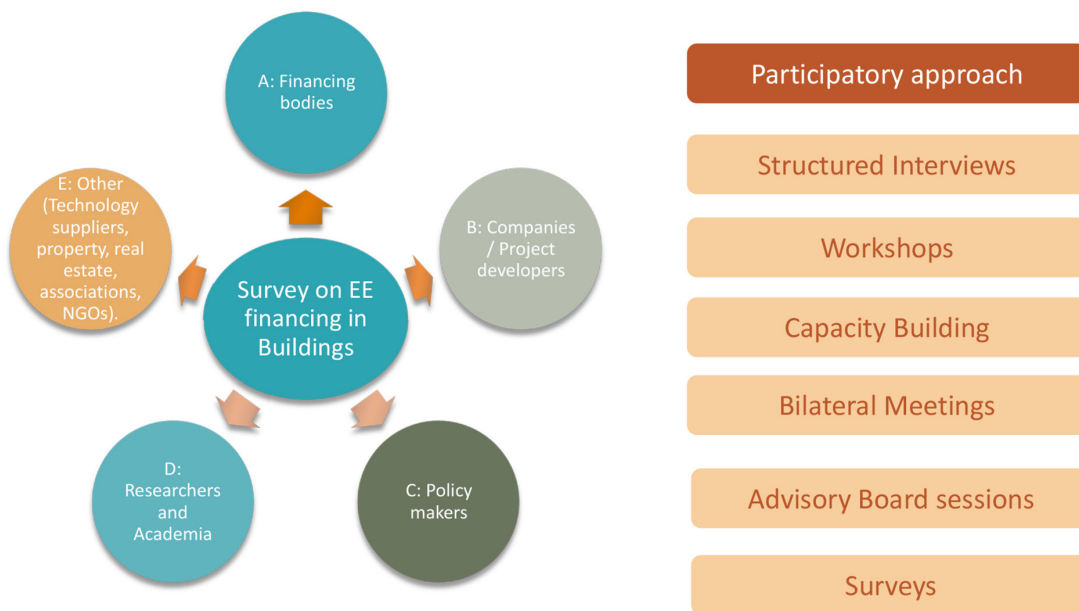


Figure 3. Participatory Approach for Stakeholders Engagement

The methodology relies on its target groups, which are the key actors to enable the development, implementation, testing and exploitation of the innovative scheme for energy efficiency financing. The key stakeholders that participate in the entire energy efficiency investments' value chain are the ones that can provide the required knowledge to achieve the objective of the proposed methodology (Figure 3). The scope is to effectively engage key actors. In the above context, a stakeholder engagement process should take place with various actions, from capacity-building workshops and events to bilateral and multilateral consultations, etc. utilizing various consultation means to effectively and actively engage key stakeholders in the process.

4. FUTURE RESEARCH DIRECTIONS

Further research directions should include a materialization of this methodological approach including co-creation and validation process by key players leading to fulfilment of their requirements and consequently market needs. The creation of a successful and satisfiable by all sides ICT tools must contemplate and substantially resolve challenges such as structural (e.g., fragmented market, regulatory instability, energy crisis), financial challenges (e.g., lack of performance evidence, high cost of capital, lack of senior debt financing, lack of standardisation, high transaction cost) and behavioural challenges (e.g., lack of information, lack of trust). Therefore, these deals should satisfy all relevant stakeholders who serve the full potential scale of the market both on the supply and demand side and consequently engage successfully all relevant stakeholders. One other direction for future work that should be taken into consideration is the exploitation of lessons learned, implications and recommendations per country, but also for Europe as a whole to further standardise the development and processes of financing energy efficiency projects. Due to the lack of data on energy efficiency projects' performance, there is an undeniable need for gathering performance data and reporting risks and value at both national and EU levels including measurement and verification, performance data and risk assessment. The proposed methodology will work towards this direction by using already existing, open data and information, best practices and recommendations from previous research work and especially research projects where a significant amount of data for energy efficiency projects have been gathered, identified, assessed and implemented.

5. CONCLUSION

Energy efficiency projects represent an attractive investment opportunity; however, many technical branches need to be overcome to reduce time and effort and increase transparency and efficiency of decision-making processing. The present study proposes a methodology including concrete steps toward the promotion of energy efficiency investments. The proposed methodology and the proposed platform workflow build to maximize the interaction with key actors and stakeholders.

Going through some concluding remarks arising from this study it should be highlighted that the proposed methodology aims to facilitate the creation of an effective, ICT-enabled, energy-efficiency marketplace to merge the requirements of key stakeholders and bring together energy services and sustainable finance to accelerate the renovation rate of buildings, by increasing the chances for energy efficiency projects for buildings to be financed, since it supports the development, implementation, monitoring and enforcement for increased energy efficiency. It should be noted that the proposed methodology enables the reflection of all targeted stakeholders. The success is based on their contribution to the ICT platform value workflow and in the EE project cycle in general.

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The Legal Challenges of the Metaverse: Business Trademarks*

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Keywords:

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NFS;
Trademark law



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Abstract: *The Metaverse is emerging as a hotbed for brand promotion as well as a platform for creating and using intellectual property rights including trademarks. The avatars (users) can create digital objects to sell to other users. Lenders and investors are seeking opportunities to capitalize on new Metaverse markets and digital assets as is the named NFT (not-fungible token) that is the unique data coding that can be visually represented by a digital asset, for example, a virtual handbag.*

Currently one of the real-world lawsuits involving trademarks and NFTs is the dispute between fashion house Hermès vs NFT creator Mason Rothschild. Hermès makes the exclusive line of Birkin handbags and Rothschild started selling NFTs in the form of digital images he named MetaBirkins which are the virtual reproduction of the Hermès product. Therefore, the fashion house filed a trademark claim for unauthorized use of their trademark and design.

From the above-mentioned lawsuit raises a set of fascinating issues at the intersection of intellectual property law and digital technology. For instance, the unauthorized trademark use in Metaverse, but what, in our view, is the most important challenge is: Can you have a trademark right on an NFT? Trademark owners should be aware of the opportunities and challenges to their brand in virtual worlds.

The possibilities for a Metaverse are currently limitless and the investments being made in new Metaverse-related technologies and platforms have grown enormously. Investors and companies are spending purchasing digital land in popular Metaverses to create virtual business spaces where consumers are sold goods, services, or entertainment.

1. INTRODUCTION

Since the origins of recorded history, businesses have been using trademarks to identify and distinguish their products or services from those of the same kind and quality. Traditionally, because of the importance of trademarks for trade and industry throughout the world, most countries have adopted legislation to enforce their rights against real-world infringers. In the 21st century, however, the trademark owners must be aware of Metaverse world infringers.

A type of platform has been recently reborn and this time it is called Metaverse. Over 14 years ago I wrote a law review article about “The Challenges of Trademark Law in virtual worlds such as Second Life (SL)”. The article discusses the use of trademark rights and Intellectual Property rights over creations developed in the virtual worlds.

SL is described by its creators as a “3D online world with a rapidly growing population from more than 100 countries around the globe, in which the residents themselves create and build the world,

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which includes, homes, vehicles, night clubs, stores, landscapes, clothing and games. SL residents are online persons, called avatars created by their users that produce and build virtual businesses that participate in a real economy” (Lastiri Santiago, 2008).² It is a very similar concept that the Metaverse currently has, in fact, SL has been one of the first metaverses that have existed.

I remember everyone who read the article was surprised and couldn’t understand why people would pay exorbitant amounts of money for land in Second Life. And now, in 2023, I find myself writing about it again. Except this time, it’s not such a foreign topic for everyone. Ever since in October 2021, Facebook announced its pivot to virtual reality when it rebranded as Meta. The goal this time is “to be seen as a metaverse company” and not merely a social media brand. After that announcement, the plots of land in the metaverse have grown by as much as 500% in just the last year. Since then, there has been a movement by platforms and brands to embrace the metaverse, along with non-fungible token (NFT) (Chambers et al., 2022a).

Is Metaverse the new big thing? Is it now? We should remember what happened with SL that went from being the boom to being forgotten. In this sense, while some commentators suggest that the metaverse is over-hyped, the switch to remote working and virtual social events intensified by the restriction of physical movement and public spaces during the pandemic, has undoubtedly accelerated people’s reliance on digital experiences. We have increasingly relied on the Internet for education, industry, art, and social activities. The last big thing was the Internet of all things which boasted and touted the interconnectivity of all things. In 2023, it’s the metaverse, which also promotes interconnectivity but in a whole different realm.

The purpose of this article is to provide the subjects that Trademark Law must deal with in digital transformation, specifically in the Metaverse, which at the very least obliges companies to renew themselves and take new measures to successfully protect their rights over their brands. Accordingly, this article will give an overview of the current legal questions that may arise in relation to trademarks lay field. This perspective is of interest since any regulation of trademark law needs to take account of the overall economic impact.

2. WHAT IS THE METAVERSE?

Taken from the prefix ‘meta’, meaning beyond or transcending, the idea proposes the digitization of our physical lives such that we work, learn, and socialize within a 3D virtual reality (Caleb & Brown, 2021). There is no unique definition of the metaverse. The truth is that by now, no one knows what exactly is. There is a general feeling of what it can do.

According to Facebook Founder the Metaverse is the “next version of the Internet that allows users to immerse themselves into real-time rendered 3D virtual worlds”. However, can be understood as a 3D version of the Internet, accessed using a virtual reality headset or glasses. But it ranges from a fully immersive, virtual reality world to a layering of digital content over the real world, where people will socialize, shop, do business, buy real estate, and learn (Chambers et al., 2022a).

² In 2007 it was corroborated that 830 residents make more than US 1,00 a month in SL. Some resident’s SL business activities have been successful enough to replace their real-life income. The virtual real estate market in SL has created market with a collective value estimated to be in the hundreds of millions of U.S. dollars, and the economy in this platform was, at that time, hundreds of millions of U.S. dollars. Time magazine reported that \$ 6,8 million changed hands in June 2007 on LindeX (SL coin) and that U.S. Congress was looking into whether to tax this commerce.

In such a digital environment, businesses can replicate the products and services that exist in the “real” world to create exciting, interactive virtual products and services, and boost revenues in the process (Chambers et al., 2022a). This notion is just like the one we can find in the Second Life metaverse. The difference between the technological advancements in the space of augmented reality (AR), virtual reality (VR), artificial intelligence (AI), blockchain and the existence of NFT are diving into the transition from our current usage of the internet to the metaverse. That said, we can conceive this universe as a set of technologies that come together, that give rise to what we are calling the metaverse.

The metaverse will integrate all these technologies so that interactions between the real and virtual worlds are as tight and seamless as possible. This scenario allows individuals to interact with one another within virtual worlds or spaces through digital or augmented reality technologies that have an online economy. The Metaverse is not a solitary online space, but instead, multiple metaverses operated by distinct entities. In this sense, Tim Sweeney (Epic Games CEO), sees the metaverse as a potential “multi-trillion-dollar part of the world economy” which, like the internet as we know it today (web 2.0), would not be owned by any specific corporation (Canavesi, 2022a).³

2.1. Metaverse Platforms Categories

2.1.1. Centralized Metaverse

As its name indicates centralized metaverse is controlled by a central entity. They have their internal servers and own policies that regulate each virtual world. The users of this kind of centralized Metaverse are restricted within the set-controlled parameters. The users can interact and share experiences, but their freedom is restricted. They cannot own pieces of the digital environment or have the freedom to control it. Fornite and Roblox are the best examples today (Shubham, 2022).

The main peculiarity of this type of Metaverse is that they can determine the Terms and Conditions which can include Intellectual Property Rights Protection and, for instance, established privacy and data protection rules, among other issues. The abovementioned matter is important if we take “Meta” as an example. The company’s business model revolves around data. The company then uses the gathered data to allow third parties to show Facebook’s users targeted advertising, and it also shares the data directly with other technology firms, including Amazon, Apple, Microsoft, Netflix, and Yandex.

A Meta-controlled metaverse consisting of virtual reality experiences like Horizon Worlds, Venues, and Workrooms accessible via Meta’s Oculus Quest headsets would present an infinite number of opportunities to analyze all user activity, including what virtual content users interact with and for how long. “Meta” could then use the collected data to transform its metaverse for the benefit of advertisers and its business partners (Shubham, 2022).

³ Currently some biggest tech players entering the space. In addition to Meta, Microsoft is launching tools to create immersive spaces with augmented and virtual reality; Apple, is getting ready to launch its first virtual reality headset followed by their first AR focused wearable; NVIDIA believes the Metaverse will be a massive opportunity for the company’s hardware and software business; Epic Games is making billions of dollars with Fornite that is a popular proto-metaverse where millions of players from around the world gather together in a virtual world to play games, chill, and attend concerts; Disney was awarded the patent in late December 2021 for a technology capable of tracking mobile devices to create personalized 3D projected overlays on physical spaces. This patent would allow the media giant to superimpose digital content on real-world environments, by passing the need for virtual and augmented reality (VR/AR) head-mounted displays.

2.1.2. Decentralized Metaverse

The difference in this Metaverse category has to do with control, creation and governance. This kind of Metaverse is built and established by communities (the more decentralized the digital world, the more the users have a full government of the project). It is an open-sourced platform where users enjoy the freedom to control everything.

Decentralized Metaverse also has a control that lies within the community. Users govern the control. They also have a lot of individual control over their assets. They can buy and sell as per their wishes (Shubham, 2022). Blockchain and cryptoassets technologies are key components of decentralized metaverses. The reason for this affirmation is that the abovementioned are transparent and traceable methods for conducting transactions and interacting with each other.

The most prominent representative of the decentralized metaverse is Decentraland, a fully decentralized world on the Ethereum blockchain, controlled by a Decentralized Autonomous Organization (DAO) made up of individual players who can vote to change the policies that determine how the world behaves. Decentraland has its own cryptocurrency, MANA, and this cryptocurrency can be freely exchanged on cryptocurrency exchanges for other currencies (Canavesi, 2022a).

Other representatives of the decentralized metaverse include The Sandbox and Somnium Space. Together with Decentraland tokenize in-game assets and land parcels to give players the ultimate control over the world they inhabit and help create -the same control they enjoy over their real-world possessions. The Decentralized Metaverse is merging hand in hand with blockchain projects (Canavesi, 2022a).

3. HOW METAVERSES ARE CONNECTED TO TRADEMARK LAW WORLD: NFT'S

The Metaverses offers a new means of brand promotion as well as a new platform for creating and using intellectual property rights and, consequently, for possible trademark infringements (WIPO, 2007).

The so-called Non-Fungible Tokens (NFTs) are one of the main tools that make conceivable the connection between tangible and intangible worlds. This is because the NFTs can represent both physical and digital assets, and in both cases allow for verification of authenticity, origin and ownership.

NFTs are non-fungible, therefore they can't be exchanged for another asset of the same type because each NFT has some unique qualities known commonly as attributes. Since NFTs are stored on various blockchains, they can't be endlessly replicated and shared.⁴ The non-fungible tokens are cryptographic assets on a blockchain with unique identification codes and metadata that distinguish them from each other. All NFTs have two key properties that separate them from cryptocurrencies like bitcoins and traditional digital assets:

⁴ From the first known NFT, called Quantum, was created by Kevin MacCoy and Anil Dash in May 2014, there has been an endless stream of NFT-related headlines, often featuring an obscenely large sum of money that some paid for the privilege of ownership. The best example is the most expensive NFT sold so far. It is a unique digital artwork called The Merge. Created by a renowned artist who goes by the pseudonym Pak, this fragmented piece of art was sold for \$ 9.8 million to 28, 983 collectors. In addition to artists, NFT collections are being minted by growing list of celebrities and brands including the NBA, Formula 1, Coca-cola, Taco Bell, among others.

- 1) They are non-fungible and
- 2) They are scarce (Block, 2021; Canavesi, 2022b).

The NFTs work as follows:

- 1) an NFT refers to unique crypto tokens that are managed on the blockchain. A blockchain acts as the decentralized ledger that tracks the ownership and transaction history of each unique NFT. The main difference between NFTs and another traditional cryptocurrency like Bitcoin is interchangeability (or lack thereof). One bitcoin in a digital wallet is interchangeable with another bitcoin in a different wallet because each bitcoin has the same value and use. NFTs, in contrast, are coded to have unique identifications and other metadata that no other token can replicate. This gives NFTs the attributes of originality and scarcity that make them so attractive when coupled with digital media (Mahmood, 2021).
- 2) NFTs are written with software code called smart contracts that govern actions such as verifying the ownership and managing the transferability of the NFTs. Like any software application, NFTs can be programmed beyond the basics of ownership and transferability to also include a variety of other applications and functionality, including linking the NFT to another digital asset. For example, a smart contract could be written to automatically allocate a portion of the amounts paid for any subsequent sale of the NFT back to the original owner, thus giving the owner the ability to realize the benefits of the secondary marketplace (Mahmood, 2021).

Thus, when someone builds an NFT, they are writing the underlying smart contract code that governs the qualities of the NFT and adding those qualities to the relevant blockchain on which the NFT is managed (Mahmood, 2021). Therefore, three technologies are fundamental to the NFT ecosystem; blockchain, smart contracts and metaverse

3.1. Blockchain

Blockchain is a storage technology where thousands of computers act together to record transactions in a ledger. This technology can be used to record transactions that are guaranteed by the blockchain to be unchangeable. An example of a transaction stored on the blockchain is a transfer of funds from one account, or “wallet” to another.

The blockchain has some fundamental applications since it offers possibilities for brand protection and registration as evidence, either at the registry stage or in case of litigation. For instance, evidence of creatorship and authentication, registering and clearing trademark rights; controlling and tracking the distribution of (un)registered trademark; providing evidence of genuine and/or first use in trade and/or commerce; digital rights management establishing and enforcing licenses or exclusive distribution agreements through smart contracts; and transmitting payments in real-time to trademark owners. Blockchain may be also used for authentication and provenance purposes in the detection and/or retrieval of counterfeit, stolen and parallel-imported goods (Clark, 2018).

3.2. Smart Contracts

This term can be confusing because they are non-contracts in the legal sense, instead, smart contracts are small computer programs that are executed to record transactions in the blockchain. Typically, the computer program of a smart contract will check various conditions and, if

the conditions are met, it will create new transactions on the blockchain. In a few words, smart contracts are digital contracts stored on a blockchain that are automatically executed when pre-determined terms and conditions are met (Sheldon & Vandsburger, 2021).

3.3. Metaverse

An NFT is a data code that allows a physical product or service to become digital and visible in the Metaverse. Thus, one of the most important properties of the metaverse is data. In this sense, data continuity as core property of the metaverse is an essential issue, because enables users to seamlessly move between virtual worlds, taking their digital possessions with them in the same manner people take their physical goods with them when they move to a different place. NFTs allow for all virtual items in the metaverse to be uniquely identifiable, purchasable, and exchangeable on the NFT marketplaces.

4. FACING A NEW CHALLENGE IN A TRADEMARK LAW WORLD: METAVERSE

4.1. The First Lawsuits Regarding Metaverse and Trademarks

The popularity of NFTs has brought with it numerous lawsuits, as companies and creators look to navigate the volatile market for such digital tokens, and in many of the interesting cases to date, the intellectual property issues that have come hand in hand with the use of the relatively novel technology. In this regard, these cases provide some guidance to describe the main legal issues related to trademark law in connection with Web 3 focused World.

As usually happens in the realm of new technologies, the key lawsuits over Metaverse regarding trademarks that have been filed in the United States of America (USA):

4.1.1. MetaBirkins Case

In January 2022, Hermès sued Mason Rothschild (Hermès International v. Mason Rothschild, 2022a) in the Southern District of New York for trademark infringement, federal trademark dilution, false designations of origin, false descriptions and representations, cybersquatting, injury to business reputation, misappropriation, and unfair competition for the creation and sale of a unique collection of 100 individual “MetaBirkins” bag NFTs that resemble fur-covered versions of the Hermès iconic Birkin bag. The complaint claims that in furtherance of his sale of the NFTs, Rothschild simply:

“rip[s] off Hermès’ famous BIRKIN trademark by adding the generic prefix ‘meta,’” which refers to “virtual worlds and economies where digital assets such as NFTs can be sold and traded.”

In response, the defendant pushed for a dismissal of Hermès’ lawsuit based on the so-called *Rogers Test* (Rogers v. Grimaldi, 1988) asserting that “fanciful depictions of fur-covered Birkin bags and the identification of his artworks as ‘MetaBirkins’ are artistically relevant and do not explicitly mislead about their source or content,” and thus, are protected as artistic expression under the First Amendment.

Hermès opposed (Hermès International v. Mason Rothschild, 2022b) alleging that the Polaroid factors (Polaroid Corp. v. Polarad Electronics Corp, 1961) should apply, instead of the *Roger*

Test in order to assess likelihood of confusion. Accordingly, the court denied Rothchild's motion dismiss, concluding that while there may be an "artistic aspect" to the images tied to the MetaBirkins NFTs (making the *Rogers* test applicable), Hermès has, nonetheless, sufficiently set out allegations that Rothschild's use of "MetaBirkins" was not artistically relevant or was explicitly misleading and therefore, failed to meet the *Rogers* test (Chakrabarti et al., 2022).

In December 2022 the US Judge Jed S. Rakoff denied both parties' motion of summary judgment on whether Rothschild's use of the Birkin bag image in his art caused consumer confusion and infringed on Hermès's trademarks. The jury trial will begin in the US District Court for the Southern District of New York on January 30, 2023 (Poritz, 2022).

4.1.2. Nike Case

In February 2022, Nike sued online reseller StockX marketplace in New York Federal Court (Nike, Inc v. StockX LLC, 2022a), alleging trademark infringement and dilution, as well as unfair competition, in connection with its offering up of NFTs tied to images and physical versions of Nike footwear albeit without receiving its authorization.

Additionally, Nike claims that the defendant is "selling those NFTs at heavily inflated prices to unsuspecting consumers who believe or are likely to believe that those 'investible digital assets' are, in fact, authorized by Nike. Consequently, hurts Nike's business reputation because StockX is building NFTs that use Nike's trademark, capitalizing on Nike's goodwill.

In response (Nike, Inc v. StockX LLC, 2022b), StockX argues "fair use", stating that this is "no different than major e-commerce retailers and marketplaces who use images and descriptions of products to sell physical sneakers and other goods, which consumers see (and are not confused by) every single day".⁵ By the same, the defendant continues to depict Nike's Complaint as nothing more than a "baseless and misleading attempt" to interfere with a new technology that Nike does not understand, which has opened up a secondary market for the sale of StockX's sneaker and other goods.

Later, Nike amended its complaint to add counterfeiting and false advertising claims. The defendant responded by denying the claims asserting that the "lack merit, disregard settled doctrines of trademark law... and show a fundamental misunderstanding of the various functions NFTs can serve" (Dolmetsch, 2022). Also, Stock claim that the NFTs at issue are little more than "claim tickets" or "digital receipts" used to "track ownership of a specific physical Nike product that StockX has purportedly authenticated using its 'proprietary, multi-step authentication process'" – putting the sale of the sneakers (and corresponding NFTs) firmly within the realm of the First Sale Doctrine (Dolmetsch, 2022).

Regarding Nike's counterfeit allegations, StockX responded in June 2022 stating that Nike itself has previously praised them: "In the past, Nike has sought to collaborate with StockX and has communicated confidence in the StockX authentication process". We will see how this legal battle ends. However, what we must emphasize is that this conflict starts over NFTs enterprises looking for its entry into the metaverse and its trademark law divergences.

⁵ The difference from the Hermès case is that StockX argues that its Vault NFTs are not "virtual products" or "digital sneakers". Rather, each Vault NFT is to a specific physical good that has already been authenticated by StockX, including "styles of shows originally manufactured and sold by Nike, Adidas, and Puma". It further described its Vault NFT collection as simply the "key" to access the underlying stored item in the vault, with no other form of intrinsic value.

4.1.3. Yuga Labs Case

In June 2022 Yuga Labs, the creator of the famous Bored Ape Yacht Club, (BAYC) sued the artist Ryder Ripps and other groups of defendants in California Federal Courts for trademark infringement, false designation of origin, cybersquatting, conversion, unjust enrichment, violations of California Business and Professions Code, intentional interference with prospective economic advantage, and negligent interference with prospective economic advantage for creating and selling NFTs that bear “the very same trademarks that Yuga Labs uses to promote and sell the authentic BAYC NFTs” (Zerbo, 2022).

In furtherance of his alleged quest to “devalue the Bored Ape NFTs by flooding the NFT market with his own copycat NFT collection using the original Bored Ape Yacht Club images and calling his NFTs ‘RR/BAYC’ NFTs,” Yuga Labs argues that the defendants have obtained a big profit from these sales, all while simultaneously using its trademarks to promote “the imminent launch of an entire NFT marketplace called ‘Ape Market’ solely to sell the RR/BAYC NFTs alongside authentic Yuga Labs NFTs” (Zerbo, 2022).

4.1.4. Quentin Tarantino Case

In November 2021, Miramax sued Quentin Tarantino for copyright infringement, trademark infringement, and unfair competition. In addition to arguing that Tarantino is likely to confuse consumers about the source of the Pulp Fiction-linked NFTs, Miramax alleges that Tarantino is on the hook for breach of contract, as his “narrowly-drafted” Reserved Rights (as distinct from Miramax’s “broad, catch-all rights,” which include “all rights . . . now or hereafter known. . . in all media now or hereafter known”) do not extend to his offering up of used excerpts of the screenplay as NFTs.

In response the defendant has pushed back, asserting that Quentin Tarantino’s contract is clear: “he has the right to sell NFTs of his hand-written script for Pulp Fiction and this ham-fisted attempt to prevent him from doing so will fail.” In this sense, also argue that the trademark infringement claim fails because Tarantino’s rights to the screenplay include the “Pulp Fiction” title (Miramax LLC. v. Tarantino, 2022).

In September 2022, the Filmmaker and the studio have settled the lawsuit over this NTF. A new court filing indicates the sides requested to dismiss the suit in and they offered a joint statement (Robertson, 2022).

5. UNCERTAINTIES OVER TRADEMARKS PROTECTION IN THE METAVERSE

From the above-mentioned lawsuits raises a set of fascinating issues at the intersection of trademark law and Metaverse. For instance, non-consensual use of the brands in the virtual world brings questions as does current trademark law applies to brands that get into the Metaverse? How licenses of these rights can be treated it? Regarding the legal obligation to use a trademark otherwise the owner may lose his rights will what we do in the metaverse be valid as proof of use? Can brands acquire notoriety from the metaverse? Can you have a trademark right over an NFT?

Currently, there are more questions than answers, however, this time we will refer to those questions that initially have to be considered by those brand owners who wish to enter into the world of the metaverse.

5.1. Specialty Principle and the Delimitation of Products and Services; A Trademark Strategy

It is necessary to highlight at this point that the function of a trademark is to serve as an indicator of origin, allowing consumers to distinguish the goods and services of a company from the ones of its competitors in the market. Therefore, trademark law grants an exclusive right and confers protection to a sign or logo in relation to the goods and services designated in the application.

In order to provide answers to the questions raised, we must start from the root of the trademark law in force in most jurisdictions. This kind of right stands on two fundamental principles, one of them is the principle of specialty and the other is the territoriality principle. Both are going to be fundamental issues in the metaverse.

In most jurisdictions, the initial phase to protect a brand must have distinctiveness and the protection extends to registration or use (depending on the country). In the case that the law of a specific country requires the registration to obtain an exclusive right over the mark the specialty of the trademark is demanded as one of its essential conditions.

The brand is special in the sense that it only applies to the category of products or services for which it has been created. From here arises the general rule, according to which the trademark cannot be registered to protect, indefinitely, any merchandise, since the scope of ownership of a trademark is limited to the protection of the products for which it was registered. This means, in principle, that the same trademark can be registered by any other person to distinguish products of another class.

The classification of goods and services is performed following the Nice Classification of Goods and Services. Notwithstanding, the first question that brand owners currently face is whether they can simply rely on existing trademark rights when it comes to enforcement in the metaverse and thus, avoid lodging separate applications for virtual goods and services? That is if the protection given by current law and the classification system would apply to the Metaverse.

For many companies, a strong brand portfolio in the real world is likely to be valuable in the virtual one. The products existing in the Metaverse, like clothing, shoes, or objects, are just the virtual appearance of the real product. They are represented by utilizing NFTs as well as services. Regarding the latter, there is a concern that is becoming common to have enterprises selling their products in the Metaverse, which can be purchased both for the avatars, but at the same time for real life. An example of this is McDonald's, which is developing a system to offer real-life delivery with an order placed in the Metaverse (European Innovation Council and SMEs Executive Agency, 2022).

The brand owner must protect figurative marks that may appeal to digital artists, as well as word marks and logos. Nevertheless, the uncertainty that arises with the blurring of the physical and digital space and the fact that still no clear decision in the ongoing infringement cases in the U.S. in which companies rely on their "real world" trademark rights to claim infringement in connection with NFTs and early iterations of the metaverse, has caused an increase of trademark applications for marks that companies are using, or planning to use, on virtual goods and/or NFTs across the world (Johnson, 2022).⁶

6 In the U.S. 4,049 "NFT-related" trademark applications for registration and 2,717 applications for virtual

In the beginning, to address this situation, trademark owners have had to resort to their creativity in the applications they have filed with the national offices, trying to adapt the Nice Classification system to their needs. This is to make sure that goods and services designated in their trademark applications are classified correctly namely as virtual products.

In 2022, the U.S. Patent and Trademark Office (USPTO) is starting to work its way through the throngs of metaverse-centric trademark applications. Part of that process has seen the trademark office issuing Notices of Allowance – preliminary green-lights of sorts in response to an array of intent to use applications, which are looking to use marks “downloadable virtual goods” (in Class 9), “retail store services featuring virtual goods” (Class 35), and/or “entertainment services, namely, providing on-line, non-downloadable virtual [goods],” etc. (Class 41), “Operating virtual services business featuring actual and virtual goods; and delivery in the real and virtual world” in order to cater to consumers in the virtual world (TFL, 2022a).

In the European Union in an attempt to provide some initial guidance as to the approach that it is taking for classification purposes, the European Union Intellectual Property Office (EUIPO) informed that:

“The 12th Edition of the Nice Classification will incorporate the term *downloadable digital files authenticates by non-fungible tokens* in Class 9. NFTs are treated as unique digital certificates registered in a blockchain, which authenticate digital items but are distinct from those digital items. For the Office, the term *non fungible tokens* on its own is not acceptable. The type of digital item authenticated by the NFT must be specified.

This new edition of the Nice Classification enters into force on January 1st, 2023. This twelfth edition includes several changes and definitely will give a worthy idea of what direction to take in meta-trademark applications. Unlike the aforesaid trademark systems, there is the China Classification that does not provide any description that would fully fit goods and services for trademarks used in the metaverse”. The description must be chosen from those available in the Chinese Classification system which is strict formalism in the selection and designation of goods and services from a classes/subclasses structure with rigid description (TFL, 2022b).

For all the above, it is a fact that the marks related to the metaverse must be registered, for the time being, as separate marks from those of real life. We must be aware of the solutions issued by the courts in the litigation that is currently being settled: the system can lead to disputes if a third party is commercializing them, without the right holder’s authorization or can constitute a misleading for consumers to think that the digital product and the real one has the same commercial origin.

It is more straightforward to demonstrate that a mark has been infringed when you can point to identical goods/services, as opposed to merely similar goods/services. For similar goods/services, there must be a likelihood of confusion (as to the source of the goods/services) in order to prove infringement.

The degree of similarity of goods and services in the “real” world to their digital counterparts will be a question of fact. Advisory services, whether provided in a virtual meeting room or

goods/ services were filed with the USPTO between January 1 and May 31 by brands ranging from retail titans like Walmart to famed luxury goods brands. This kind of applications also rise in the European Union, where companies are readily lodging similar applications.

a physical office are arguably the same, regardless of the delivery mechanism. In contrast, the pair of branded sneakers you wear in the physical world is arguably an entirely different product (footwear) from the digital representation of those branded sneakers that you purchase for your avatar (data and software). In the case of dissimilar products or services, only brands with reputations will be protected (Chambers et al., 2022a).

5.2. Unregistered Rights. The Trademark Right That Is Obtained with the Use (Without the Need for Registration)

Unregistered rights are less readily understood by potential infringers than registered rights, less certain and the protection they confer differs widely between jurisdictions (Chambers et al., 2022a). Accordingly, in contrast to the countries where registration is necessary to obtain the trademark right, in jurisdictions such as the U.S.A, the right can be relied on the fact or nature of use or for example, companies like Hermès that don't want to use its brands in the metaverse; can it establish its marks are famous and thereby protect them from meta uses? In this case, Hermès might well be able to argue that unauthorized meta-use tarnishes the unique brand that is Hermès. But other less well-known brands might have a much tougher legal road. They might have to rely upon the likelihood of confusion analysis that is the basis of a trademark infringement claim. In that circumstance, the owner of the trademark could face an adverse decision; a court might narrowly focus on whether the respective good and services, virtual and real, are similar, or on very different channels of trade, as might a trademark office when considering opposition to an application for virtual goods. Trademark owners may need to estimate whether they should also argue for false advertising, as well as claims at common law, such as misappropriation and passing off (Park, 2022).

5.3. The Applicable Law: Principle of Territoriality

The principle of territoriality means that the trademark affects the territorial area where its registration has been requested or in the case of use, where the use has been asked (in the entire national or regional territory). Consequently, an additional fundamental question arises: who has control of the metaverse, and which jurisdictions are relevant? With regards to control, the more control an organizing entity has in the case of the centralized metaverse, the more likely policies, such as notice and takedown mechanisms, will be in place to enforce trademark infringement. In contrast, as it happened in decentralized metaverse platforms, such as Decentraland, which is owned by users and governed by a decentralized autonomous organization (DAO'S) it will be difficult to formulate and enforce policies that allow brand owners to participate while also ensuring that their intellectual property is protected (Fält et al., 2022).

Also, we have to refer what would be the applicable law? In this sense, the factors that the courts take generally into account when assessing whether a website targets consumers (offering goods or services for delivery to a certain country, the use of the top-level domain names, the language of the website, etc.) may be more complex in the metaverse since these kinds of platforms have their cryptocurrencies and be hosted in a decentralized way, with real-time translation of content. However, we are not in unknown land if we remember what has already been done when the Internet arrived, applying the WIPO recommendations taking into account the changes that the metaverse implies (WIPO, 2022).⁷

⁷ Wipo. *Joint Recommendation Concerning Provisions on the Protection of Marks, and Other Industrial Property Rights in Signs, On the Internet (with Explanatory Notes)*. Adopted BY THE assembly of the Paris Union for the protection of Industrial Property and the General Assembly of the World Intellectual Property Organization (WIPO) at the Thirty-Sixth Series of Meeting of the Assemblies of the Member States of WIPO.

5.4. Use in Commerce

As mentioned, to maintain a trademark right, these must be used. Likewise, trademark infringement requires use in commerce. In this regard, the Courts have said that there is use in economic traffic when the use is made in the context of economic activity, for profit-seeking and that is not for strictly private purposes.

As an example, we can mention the Hèmes case where the Metabirkins NFTs were sold for 23,500 euros. In that event, it seems that the economic context in which it was carried out and the profit motive constitute commercial use. Nevertheless, it is unclear whether a private individual making an NFT of, for example, Nike trainers to be worn by their avatar in the metaverse may constitute a trademark infringement, although it is likely to qualify as a type of passing off (similar to fraudulent registration of domain names for famous brands) (Chambers et al., 2022b).

6. CONCLUSION

We have already witnessed on several occasions that small technological innovation is enough to render numerous legal rules useless. Technological advances provide new opportunities for trademark owners but also hinder the ability of incumbents to control their exploitation. The metaverse is the new reality to face.

Even though widespread discussion would make it seem like the metaverse is a fully formed experience that is ready for use by any trademark owner at any time, this is not the case. The virtual, augmented reality, video, social media, and the web that is being devised as the metaverse is still far from fully coming into execution. Even so, the migration of activity from the physical world to online spaces has been around for a long time ago. Therefore, it seems that the current trademark law applies to the metaverse, for instance as long as the goods and services are correctly classified as virtual products.

Trademark Law has had to improve at the pace of technological advances that have been developed, considering that evolution brings with it change and therefore the restructuring of those rights that no longer deal so effectively with the reality of legal traffic. The new realities, like the metaverse, no longer disconcert, they simply motivate us to create the path that best responds to the world in which we live. Trademark owners should be considering how to construct their virtual space with appropriate trademark registrations or use their brands properly, they need to build a robust policing strategy.

This article would exceed the limits set by the space granted to us if we expanded to consider in its entirety each of the questions that can raise the metaverse in the world of trademark law. Problems such as infringers; trademark licensing terms and centralized metaverse terms and conditions remain pending. As a result, it might be useful to adapt the trademark legislation and to include specific references to the Metaverse in the law. In the near future, some enterprises will only have their commercial interests in the digital world and therefore they might seek protection for their goods and services only there.

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Guarantee of the Right to Online Education in Exceptional Situations: Case Study of the COVID-19 Pandemic

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Abstract: Covid-19 came as a challenge in human being life. After the announcement of the state of the world pandemic on March 11, 2020, by the World Health Organization, the government reacted to this situation, undertaking a series of measures considering the general interruption of social and economic activities such as closing schools, the prohibition of mass gatherings in closed or open places, the restriction or prohibition of other movements inside and outside the country, which brought the country into total quarantine for about three months. Among other things, the government also presented an action plan for the prevention and response to Covid-19 in May 2020, which provided three pillars of action: prevention, response, and recovery, to continue providing health services to the entire population. While the government's response has necessarily been swift in terms of protecting health and guaranteeing the right to life, the pandemic situation brought a new challenge, in terms of children's well-being and the effective exercise of their rights, especially in the most vulnerable children. In the situation of the global pandemic, international institutions have addressed a series of recommendations and statements for the protection and guarantee of the rights of children and their families.

In April 2020, ENOC² calls on governments, the European Commission and the Council of Europe to take all appropriate actions to ensure that the rights of all children are guaranteed in accordance with the United Nations Convention on the Rights of the Child. Children's rights and, the comments of the United Nations Committee on the Rights of the Child, should be respected during the Covid-19 health care crisis.

1. INTRODUCTION

The global pandemic situation accompanied by the measures taken to limit the movement of the population, isolation and self-quarantine, consequently brought new challenges to make it possible to guarantee the child's right to education around the globe³.

After a long interruption of the teaching process with a physical presence, the Ministry of Education and Sports (MES) faced new challenges regarding the beginning of the new academic year 2020-2021, in an uncertain pandemic period. The easing of restrictive measures created the possibility of starting the new academic year and developing the learning process, physically in the environments of educational institutions, dictated by new rules (Instruction no. 543/1, 2020).

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² ENOC is European Network of Ombudsman for Children's Rights and Albania is represented in this network through the People's Advocate institution for the Protection and Promotion of Children's Rights (Law No. 8454, 1999).

³ Specifically, the Albanian Ministry of Education and Sports was forced to stop physical attendance at schools from March 9, 2020, until the end of the 2019-2020 school year. During this period (9.3.2020-30.6.2020), MES approved the order for the continuation of the learning process through distance learning (learning in home conditions).

The drafting of these rules was the main measure undertaken at that time by the Ministry of Education and Sports and the law enforcement institutions of this institution in cooperation with the Ministry of Health and Social Protection. This guideline in addition to helping and supporting educational institutions to ensure quality and comprehensive education, also defines rules for having safe environments for students, teaching, and support staff.

During the 2020-2021 academic year, the development of the learning process was made possible with the physical presence of students in 1266 schools, including dependent institutions (educational offices, regional educational directorates, etc.). At the national level, dictated by the conditions of the pandemic (physical distancing), in 567 educational institutions⁴ the educational process has been developed with two, three and four shifts (*Synthetic Report of the People Advocate Institution, 2021*).

2. SERIOUS DEFICIENCIES FOUND REGARDING THE EXERCISE OF CHILDREN'S RIGHTS, ESPECIALLY THE RIGHT TO EDUCATION

The biggest concerns based on the problems identified during the pandemic situation and especially the development of the *online* learning process, during the period of movement restrictions at the beginning of the pandemic (*Avokati i Popullit, 2022*), consisted in:

- The access of children with disabilities to the educational system, not having the right access to the teaching process with suitable and effective services for them;
- The inequality in access to the teaching process (lack of access of children in need to social networks and innovative technology equipment);
- The training of teachers in the use of new innovative online communication programs and access to technology devices;
- The security of the child's privacy during online learning;
- The student's well-being (psycho-social support and mental health) is caused by movement restrictions.

Regarding the violation of the right to the education of children with disabilities, the Ministry of Education informed that, where specific guidelines for the education of children with disabilities were given, special schools were specifically instructed to develop and implement internal protocols, taking care that the return to the school should first ensure the health of the child, whereby the school staff, in cooperation with the evaluation committee and the parent, should carefully assess the condition of each student who then attends a special school, as well as students who enroll in the school for the first time, determining for each student the manner of behavior and interaction with school staff and other students, both during their stay in the classroom and in other environments of the institution.

What was found during the academic year 2021, had to do with the fact that the development of the learning/conjunctive process, combined with several scenarios, applied for the first time in our country (with a physical presence in the school premises, the development of the process online in home conditions and, both together), also necessarily requires additional resources in infrastructure, budget, human resources, improved curricula and continuous education of teachers in information and communication technology.

⁴ The number of students, according to educational levels in educational institutions, where the learning process takes place in shifts, was 1318 students of primary education, 148739 students of secondary education and 57760 students of higher secondary education.

Through this approach, what needs to be assessed is whether the principle of the child's best interest has been kept as a primary consideration in the process of drafting and implementing the above-mentioned by-laws, in response to the pandemic.

Also, the human, infrastructural and financial resources were sufficient for the effective management of the situation, in the protection and guarantee of children's rights.

It is important to note that the measures taken in every field of life activity (including that of education), to fight the pandemic caused by the Covid-19 virus and any other subsequent measures, must be in proportion to the situation dictated, as well as following human rights standards.

3. FINDINGS AND PROBLEMS IN PRACTICE

Taking into account the long-standing discourse of guaranteeing children's rights, to make possible the functioning of the consolidated democratic system, through continuous education, in respect of their rights, even in the pandemic period by educational institutions, as well as in order to have an impartial approach, the correctness of all state bodies foreseen by the legislation on pre-university education is stated. The identified problems closely related to the Covid-19 pandemic resulted in the violation of children's rights, related to:

- The right of the child to be educated;
- The rights of children with disabilities;
- The child's right to be protected from any form of violence;
- The right to life and normal development of the child;
- The right to life and health of minors in conflict with the law and deprived of their liberty;
- Protection of children placed in residential social care institutions.

Despite the efforts of the responsible educational institutions, through the measures taken to guarantee the right to education, the educational infrastructure of our country inherits enough problems, which, in a way, turn into hindering factors, to make it possible to acquire the new approach. This is also in the context of the social economic circumstances in which the family develops as a social structure in our country. This is mainly related to the limited socio-economic opportunities to own electronic equipment or Internet lines, as well as the lack of necessary spaces in family environments. This has led to the loss of access for many children to follow and attend *online* lessons. The whole process in itself is a change and a challenge, both for the children and the teachers, and adapting to the new educational development process requires the right time, which is accompanied by anxiety and stress in the children. Precisely, this element has not been evaluated as well as how it would affect the child's conjunctive and health development.

4. CHILDREN'S RIGHTS – THE RIGHT TO EDUCATION

Education is valued as a human right in itself and as a necessary tool for realizing other rights. A rights-based education system better fulfills its mission of quality education for all (**Universal Declaration of Human Rights, 1948**)⁵. **Albanian legislation in the field of education has**

⁵ In accordance with Article 26 of the Universal Declaration of Human Rights, it is provided that every individual has the right to education. Education should be free, at least primary and basic education. Primary education should be compulsory. Technical and vocational education should be made available on a large scale and higher education should be equally accessible to all, on the basis of merit. Education should serve the full development of the human personality and increasing respect for human rights and fundamental

advanced significantly in the last decade (Law no. 15/2017, 2017; Law no. 69/2012, 2012; Instruction no. 25, 2018; Decision of the Council of Ministers no. 98, 2019; Decision of the Council of Ministers no. 99, 2019; Decision of the Council of Ministers no. 540, 2018; Instruction no. 13, 2019). The legislative changes are mainly focused on the fulfillment of important reforms such as a competency-based curriculum, transparent and merit-based recruitment of teachers, the new governing structure of the pre-university education system, as well as the improvement of education services for citizens.

In this sense, the Ministry of Education and Sports and the dependent institutions for the education sector aim to build a comprehensive education system, which successfully addresses the individual needs of all children, pupils and students, treating them equally and with respect for diversity. Inclusion and equality are necessary prerequisites to ensure the quality education of all individuals and to narrow the educational achievement gap between different social groups. Every child within the territory of the Republic of Albania should be offered a quality and decent education, in which the student's interest is primarily in the activities of the institutions of the pre-university education system.

In this spirit, the child has the right to access and attend free, quality education, based on equal opportunities and without discrimination, under his age and ability to understand. Education must be developed, to improve knowledge in respect of basic human rights and freedoms, according to international and local standards. Also, during and after the learning and educational process, the child must be treated with dignity by every actor and institution that deals with children.

5. CONCLUSION AND RECOMMENDATIONS

So that children's education is carried out in a peaceful environment, guaranteeing their right to be educated, based on the best interest of the child, following articles 18 and 28 of the *Convention on the Rights of the Child (United Nations, 1989)* as well as the Albanian *Law no. 18/2017 (2017)* "On the rights and protection of the child", the responsible institutions are required to take the necessary legal and procedural steps; the gist of it is that everything proposed, as a measure to be undertaken, is embodied in actions concrete from the responsible state institutions so that not only the pandemic, but any other circumstance, does not prevent the achievement of the Sustainable Development Objectives settled in the Agenda 2030 of the UN (SDG 4) for education in our country.

The public authorities must take measures to create suitable environments for effective learning, through the improvement and expansion of the school infrastructure, making it possible to:

- to ensure that all schools have the functional infrastructure for the use of information (computers, laptops, smart tablets);
- to have high-speed internet and the possibility of *online* access;
- to have technical support that ensures efficient use of the infrastructure;
- to have access to education portals, in accordance with the planned curriculum;
- to have access to portals for students with different abilities.

freedoms. It should develop understanding, tolerance and friendship between all nations, races and religious groups and further the peacekeeping activities of the United Nations.

Guaranteeing children the exercise of these rights is a challenge in itself, especially in cases of crisis, pandemic, or emergencies. Therefore, especially the rights of children, concerning the situation we found ourselves in during the Covid-19 pandemic, cannot be ignored, overlooked, or violated. Therefore, it is the primary duty of the responsible state institutions to deal with new challenges, either in the institutional or in the legal aspect. Meanwhile, attention is being paid to the well-being of children and youth in Albania who continue to face challenges exacerbated by the Covid-19 pandemic. The lack of budget forecasts, following the relevant activities foreseen in the national strategies and plans, which directly affect the lives of children and, as a result, the lack of services in the community have brought more challenges that require the most appropriate solutions in the dynamics of development and children's needs.

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Additional reading

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EU Databases: One Evaluation on Recitals through the Look of the Court

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Abstract: *Abstract: In February 2022, the European Commission published the proposal of the Data Act, Art. 35 which deals with the sui generis right of database manufacturers. The Database Directive 1996/9/EC has survived again and is about to enter the EU cloud federation almost intact. This fact received several academic headlines while almost overshadowing a landmark decision of the Court of Justice of the European Union. It is the decision in the case C-762/19 – SIA “CV-Online Latvia” v SIA “Melons”, which signals the beginning of a significant change in the existing jurisprudence and has the potential to focus the blurred image of The Directive. The Court attached great importance to recital 42 from her, which gives rise to well-founded interest. This is because the qualitative and quantitative weight of recitals in the jurisprudence of the Court of Justice of the EU is little studied and not at all in the field of the legal protection of databases. It is precisely some selected aspects of the place and the meaning of recitals in the judgments of the Court of Justice of the EU in proceedings on preliminary rulings that occupy a central area in the present study.*

1. INTRODUCTION

Recitals are a mandatory part of the structure (preamble) of the legal acts of the Union, the content of which motivates the main provisions of the enacting terms of the act and which do not contain provisions of a normative nature. In an attempt to demystify their legal nature, an opinion is expressed that the reason why recitals are binding may be a political one based upon a need for reassurance (Klimas & Vaiciukaite, 2008). According to the Court of Justice of the European Union (hereinafter CJEU), “the undoubted legal value of the recitals is to give the parties to a dispute the opportunity to defend their interests and to enable the Court of Justice of the European Union to exercise its power of review” (see Case 24/62 Germany v Commission; Case C-367/95 P Commission v Sytraval and Brink’s France, paragraph 63; Case C-413/06 P Bertelsmann and Sony v Impala, paragraph 166; Case 2/56 Geitling v High Authority; Case 73/74 Groupement des fabricants de papiers peints de Belgique and Others v Commission (“Papiers peints”), paragraph 30 and Case C-439/11 P Ziegler SA v European Commission, paras 81 and 82). The same – and according to Joint Practical Guide of the European Parliament, the Council and the Commission for persons involved in the drafting of European Union legislation (para 10.2) (European Union, 2015). Whether and how in specific court cases the recitals have justified this purpose is the main subject of the present study. For this purpose, a quantitative and qualitative study of the recitals in the judicial acts of the CJEU at References for preliminary rulings was conducted on the basis of Article 267 of the Treaty on the Functioning of the EU. The judicial acts were issued in connection with the implementation of Directive 96/9/EC of the European Parliament and the Council of March 11, 1996 on the legal protection of databases (hereinafter and only Directive, Database Directive) in the period 2004-2021.

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2. DISCUSSION

The following court cases were study, listed here chronologically: Case C-338/02, Fixtures Marketing Ltd v. Svenska Spel AB, ECLI:EU:C:2004:696; Case C-46/02, Fixtures Marketing Ltd v. Oy Veikkaus Ab, ECLI:EU:C:2004:694; Case C-444/02, Fixtures Marketing Ltd v. Organismos prognostikon agonon podosfairou AE (OPAP), ECLI:EU:C:2004:697; Case C-203/02, The British Horseracing Board and Others v. and Others v William Hill Organization Ltd, ECLI:EU:C:2004:697; Case C-304/07 Directmedia Publishing GmbH v. Albert-Ludwigs-Universität Freiburg, ECLI:EU:C:2008:552; Case C-545/07, Apis-Hristovich EOOD v. Lakorda AD, ECLI:EU:C:2009:132; Case C-604/10, Football Dataco Ltd and Others v. Yahoo! UK Ltd and Others, ECLI:EU:C:2012:642; Case C-173/11 Football Dataco Ltd and Others v. Sportradar GmbH, Sportradar AG, ECLI:EU:C:2012:642; Case C-202/12 – Innoweb v. Wegener ICT Media BV, Wegener Mediaventions BV, ECLI:EU:C:2013:850; Case C-30/14 – Ryanair Ltd PR Aviation BV, ECLI:EU:C:2015:10; Case C-490/14 – Freistaat Bayern v. Verlag Esterbauer GmbH, ECLI:EU:C:2015:735; Case C-762/19 – „CV-Online Latvia“ SIA v. „Melons“ SIA, ECLI:EU:C:2021:434. The occasion for this study is the circumstance that a specific recital became the starting point for amendment in the practice of the CJEU. In the context of the Database Directive, the significant legal value of the recitals is emphasized without downplaying their political importance. The occasion for the ruling of the CJEU with a judgment is the request for a preliminary ruling of Rīgas apgabaltiesas Civillietu tiesas koleģija (The referring court), which, by rejecting the *Acte clair* doctrine in the specific case, referred the following question to the Court of the EU: “(1) Should the defendant’s activities, which consist in using a hyperlink to redirect end users to the applicant’s website, where they can consult a database of job advertisements, be interpreted as falling within the definition of “re-utilisation” in Article 7(2)(b) of Directive 96/9, more specifically, as the re-utilisation of the database by another form of transmission? (2) Should the information containing the meta tags that is shown in the defendant’s search engine be interpreted as falling within the definition of “extraction” in Article 7(2)(a) of Directive 96/9, more specifically, as the permanent or temporary transfer of all or a substantial part of the contents of a database to another medium by any means or in any form?” The Court of Justice of the EU subsequently opened the case C-762/19 CV-Online Latvia v. Melons and, after reformulating the questions put to it by The referring court, delivered its judgment on 3 June 2021. This decision is noted as important because it “introduces the *raison d’être* of database protection into the infringement test” (Derclaye & Husovec, 2022). The essence of this consists of the following. First, extraction and reuse (within the meaning of Article 7(2)(a) and (b) of the Directive) without the consent of the person who created them is prohibited by Article 7(1) of Directive 96/9, provided have the effect of depriving that person of income intended to enable him or her to redeem the cost of that investment (paragraph 37 of the decision). Second, the main criterion for balancing the legitimate interests at stake must be the potential risk to the substantial investment of the maker of the database concerned, namely the risk that that investment may not be redeemed (paragraph 44 of the decision). Therefore, the Court concludes (paragraph 46 of the judgment) the referring jurisdiction in the main proceedings must check not only has been made whether a substantial investment for the obtaining, verification or presentation of the contents of the database, but also secondly (and here is the change in the previous judicial practice), whether the extraction or re-utilisation in question constitutes a risk to the possibility of redeeming that investment. Thus it alter the trajectory of the protection in Derclaye's words, which the Court justified mainly with recital 42 of the Directive. The text of the recital is as follows: “Whereas the special right to prevent unauthorized extraction and/or re-utilization relates

to acts by the user which go beyond his legitimate rights and thereby harm the investment; whereas the right to prohibit extraction and/or re-utilization of all or a substantial part of the contents relates not only to the manufacture of a parasitical competing product but also to any user who, through his acts, causes significant detriment, evaluated qualitatively or quantitatively, to the investment”.

The quantitative study carried out on the judicial acts of the CJEU on preliminary rulings based on Article 267 TFEU on issues concerning the application of the Database Directive gives the following results, shown in Table 1.

Table 1. Results of a quantitative study of recitals in the judicial practice concerning preliminary rulings on Directive 96/9/EC

Case	Recitals	Count
1. Case C-46/02, Fixtures Marketing Ltd	7, 9, 10, 12, 19, 39, 40	7
2. C-338/02, Fixtures Marketing Ltd	7, 9, 10, 12, 19, 20, 39, 40, 42, 47, 43, 48, 55	13
3. Case C-444/0, Fixtures Marketing Ltd	7, 9, 10, 12, 13,14, 17, 21, 27, 39,40	11
4. C-203/02, The British Horseracing Board Ltd and Others	7, 9, 10, 12, 19, 39, 41, 42, 43, 44, 46, 48	11
5. C-304/07, Directmedia Publishing GmbH	7, 13, 14, 21, 38–42, 44, 47, 48	12
6. C-545/07, Apis-Hristovich EOOD	23, 38, 46	3
7. C-604/10, Football Dataco Ltd	1–4, 9, 10, 12, 15, 16, 18, 26, 27, 39, 60	14
8. C-173/11, Football Dataco Ltd		0
9. C-202/12, Innoweb	39, 42, 48	3
10. C-30/14, Ryanair Ltd	34	1
11. C-490/14, Freistaat Bayern	9, 10, 12, 14 and 17	5
12. C-762/19, „CV-Online Latvia“ SIA	7, 39–42, 47, 48	7

The following is striking. In only one judgment (C-173/11, Football Dataco Ltd and Others, ECLI:EU:C:2012:642) did the Court not refer to either recital. The most recitals – 14 (fourteen) – the Court used in its judgment in the case C-604/10, Football Dataco Ltd, ECLI:EU:C:2012:642. In total, in all examined conclusions, the Court used 33 (thirty-three) of the total existing 60 recitals in the Database Directive, which is 55% usability. For the first time, the recitals appear systematically arranged at the beginning of the judgment in the section "Legal context", "European Union law", in the judgment in case C-604/10 Football Dataco Ltd and Others v Yahoo! UK Ltd and Others (paragraph 5). The Court followed the same standard of exposition in its subsequent judgment, namely: Case C-202/12 – Innoweb BV v Wegener ICT Media BV, Wegener Mediaventions BV; Case C-490/14 – Freistaat Bayern v Verlag Esterbauer GmbH and in Case C-762/19 "CV-Online Latvia" SIA v "Melons" SIA (see para 3). This may mean that the Court regards the recitals as part of Union law and not, for example, as an introduction to it. The analysis also shows the following. In one part of **the judgments the Court (n.d.)** refers to the recitals alone, for example:

- recital 17 on how the expression "database" is to be understood, namely as ‘literary, artistic, musical or other collections of works or collections of other material such as texts, sound, images, numbers, facts, and data’ (judgment in Case C-490/14, ECLI:EU:C:2015:735, paragraph 14, and judgment in Fixtures Marketing, C-444/02, ECLI:EU:C:2004:697, paragraph 23);
- recital 14, which makes it clear that the protection afforded applies to both electronic and non-electronic databases (judgment in case C-490/14, ECLI:EU:C:2015:735, paragraph 14);

It should be noted that the Court's conclusions follow directly and immediately from the relevant recitals and independently justify the interpretation. This is clear also from the expressions used ("as referred to in recital", "as for recitals", "as follows from", "as is apparent from recitals..."),

"apparent from recital... in the preamble thereto that", "according to", "according to which", "they emphasize", "grounded an interpretation", "in the light of", "illustrate the concept"). For example:

- "Secondly, *as is apparent* from recital 16 of Directive 96/9, the notion of the author's own intellectual creation refers to the criterion of originality" (Case C-604/10, Football Dataco Ltd and others v. Yahoo! UK Ltd And others, ECLI:EU:C:2012:115, paragraph 37) or paragraph 49 below "... *as is apparent from* recital 60 of Directive 96/9, Article 3 of that directive carries out a 'harmonization of the criteria for determining whether a database is to be protected by copyright', and further paragraph 51: "*As for recitals* 18, 26 and 27 of Directive 96/9, highlighted by Football Dataco and Others, those recitals note the freedom which authors of works have to decide whether to include their works in a database and the absence of effect which the incorporation of a protected piece of work in a protected database has on the rights protecting the work thus incorporated";
- "While it is not necessary for the systematic or methodical arrangement to be physically apparent, *according to* the 21st recital..." (Case C-444/02, EU:C:2004:697, paragraph 30);
- "The quantitative assessment refers to quantifiable resources and the qualitative assessment to efforts which cannot be quantified, such as intellectual effort or energy, *according to the* 7th, 39th and 40th recitals of the preamble to the directive." (ibid., para. 44);
- "*The use*, in a number of the recitals in the preamble to Directive 96/9, *including, in particular recitals 7 and 38, of the verb 'to copy' to illustrate the concept* of extraction indicates that, in the mind of the Community legislature, that concept is intended, in the context of that directive, to cover acts which allow the database or the part of the database concerned to subsist in its initial medium" (Case C-304/07 Directmedia Publishing GmbH, ECLI:EU:C:2008:552, paragraph 30);
- Recital 14 in the preamble to Directive 96/9, according to which 'protection under this Directive should be extended to cover non-electronic databases', *as well as recital 21* in the preamble to that directive, *according to which* the protection afforded by the directive does not require the materials contained in the database to 'have been physically stored in an organised manner', also *supports an interpretation* of the concept of extraction unencumbered, in the same way as that of databases, by formal, technical or physical criteria." (ibid., para. 38);
- "Recital 38 *seeks to illustrate* the particular risk for database makers of the increasing use of digital recording technology. It cannot be interpreted as reducing the scope of the acts subject to the protection of the sui generis right merely to acts of copying by technical means." (ibid., paras 48 and 49);
- "*in the light of the 46th recital* in Directive 96/9, according to which the existence of the sui generis right does not give rise to the creation of a new right in the works, data or materials themselves, it has been held moreover that the intrinsic value of the materials affected by the act of extraction and/or re-utilisation does not constitute a relevant criterion for assessment in that regard." (Apis-Hristovich EOOD v Lakorda AD, ECLI:EU:C:2009:132, para 67).

Other recitals are used by the Court consistently together, most often the 9th, 10th and 12th recitals to clarify the purpose of the directive. "As evidenced by recitals 9, 10 and 12 in the preamble thereto, the legal protection introduced thereby is aimed at stimulating investment in data storage and processing systems in order to contribute to the development of an information market against a background of exponential growth in the amount of information generated and processed annually in all sectors of activity" – concludes the Court in the judgment in Case C-490/14, ECLI:EU:C:2015:735, paragraph 16 (see also judgments in Case C-46/02, Fixtures Marketing Ltd v Oy Veikkaus Ab, ECLI:EU:C:2004:694, paragraph 33; C-338/02, Fixtures Marketing Ltd v Svenska Spel, ECLI:EU: C:2004:696, paragraph 23; Case C-444/02

Fixtures Marketing Ltd v Organismos prognostikon agonon podosfairou AE (OPAP), ECLI:EU:C:2004:697, paragraph 39; C-203/02 – The British Horseracing Board and Others, ECLI:EU:C:2004:695, paragraph 30; Case C-604/10, Football Dataco Ltd and others v Yahoo! UK Ltd And others, ECLI:EU:C:2012:115, paragraph 34; case C-490/14 Freistaat Bayern v Verlag Esterbauer GmbH, ECLI:EU:C:2015:735, paragraph 16).

Part of the recitals are stated in a "from-to" manner, such as: "recitals 1-4" – to justify the objective of the Directive to eliminate the existing differences between national legislations from the point of view of the legal protection of databases (case 604/ 10, Football Dataco Ltd, ECLI:EU:C:2012:115, paragraph 48); "recitals 38-42" – on the purpose of the sui generis right (Case C-304/07 Directmedia Publishing GmbH ECLI:EU:C:2008:552, paragraph 33).

It also occurs as a reference to the recitals of the preamble in general, as one of the arguments for deriving the intention of the legislator. It is thus argued in paragraph 28 of Case C-444/02: *"A reading of the recitals of the preamble to the directive reveals that, given the 'exponential growth, in the Community and worldwide, in the amount of information generated and processed annually in all sectors of commerce and industry' as the 10th recital states, the legal protection provided by the directive is intended to encourage the development of systems performing a function of 'storage' and 'processing' of information, according to the 10th and 12th recitals"*.

The recitals are also used to argue the Court's conclusions in relation to the interpretation of provisions with a normative nature. For example, to retrieve the content of the expression "investment in ... the obtaining ... of the contents" of a database" in Article 7(1) of the directive the Court interpreted them in relation to recitals 9, 10 and 12 and concluded that the expression 'investment in ... the obtaining ... of the contents' be understood to refer to the resources used to seek out existing independent materials and collect them in the database, and not to the resources used for the creation as such of independent materials (In Case C-203/02, The British Horseracing Board Ltd and Others, ECLI:EU:C:2004:695 paragraph 31). Likewise in the following two paragraphs, the Court continues to support its conclusions with arguments from the recitals: "That interpretation is backed up by the 39th recital of the preamble to the directive, according to which the aim of the sui generis right is to safeguard the results of the financial and professional investment made in 'obtaining and collection of the contents' of a database." (paragraph 32). "The 19th recital of the preamble to the directive, according to which the compilation of several recordings of musical performances on a CD does not represent a substantial enough investment to be eligible under the sui generis right, provides an additional argument in support of that interpretation" (paragraph 33). A similar interpretive approach is often found in other decisions to answer the question referred to for a preliminary ruling. Likewise in Case C-604/10, Football Dataco Ltd and Others, ECLI:EU:C:2012:115, from the comparison of the relevant text of Article 3(1) and Article 7(1) of Directive 96/9, as well as from other provisions or recitals thereof, and in particular from Article 7(4) and recital 39 thereof, the Court reached the important conclusion that copyright and the right "sui generis" are "to two independent rights whose object and conditions of application are different" (paragraph 27). In Case C-604/10, as interpreting Article 3(2) in conjunction with Recital 15 of Directive 96/9 the Court makes an important conclusion " that the copyright protection provided for by that directive concerns the "structure" of the database, and not its "contents" nor, therefore, the elements constituting its contents" (paragraph 30). In case C-545/07 Apis-Hristovich EOOD v Lakorda AD, ECLI:EU:C:2009:132, the Court interpreted the concept of "extraction" in relation to recital 38: "As is confirmed by the 38th recital in Directive 96/9, it is also immaterial, for the purposes

of interpreting the concept of extraction, that the transfer of the contents of a protected database to another medium result in an arrangement or an organisation of the material concerned which is different from that in the original database” (paragraph 47).

We come to the case in which the Court gave great weight to one consideration that could be interpreted as a change to the infringement test. As stated at the beginning, it is a judgment in case C-762/19 CV-Online Latvia SIA v. Melons SIA. Recital 42 became the basic argument for the Court to rule that the main criterion for balancing the legitimate interests at stake must be the potential risk to the substantial investment of the maker of the database concerned, namely the risk that that investment may not be redeemed (paragraph 44). This paragraph of the decision is sufficient to highlight three new points compared to the previous practice of the Court: the available legitimate interests (database creators, users and competitors) must be assessed with a view to a fair balance between them; the possible impact on the essential investment is raised as a main criterion; if the extraction and/or re-utilisation in question poses a risk to the return potential of that investment, then the criterion is met. It turns out that if it does not pose such a risk, there is no violation, even if all the other conditions are present. In practice, this means that law enforcement authorities in the Union have to check a wider range of circumstances in each specific case. And for the litigants – especially for the database makers, who are most often in their procedural quality as plaintiffs – the burden of proof becomes Sisyphean and one might even say hypothetically. This is because proving the existence of a risk, as well as whether the risk is direct or eventual, means proving a wide range of facts and/or the degree of their likely manifestation and the causal relationships between them. However, the evaluation of this change in the infringement test is not the subject of the study, but only in its context highlighting the importance of the recitals in the legal acts of the Union. And finally, the analysis shows that, notwithstanding the above, the Court does not consider that the recitals have an independent normative value. The following is an example from the judgment of the Court In Case C-304/07: “That is why Article 13 of Directive 96/9, which confers normative value on the statement, contained in recital 47 in the preamble to that directive, that the provisions of that directive ‘are without prejudice to the application of Community or national competition rules’, states that that directive is to be without prejudice to provisions concerning inter alia laws on restrictive practices and unfair competition.” (paragraph 56).

3. CONCLUSION

This analysis is not intended to be exhaustive, but sufficient to support the conclusions. Recitals as a mandatory element of the preamble of Union acts are often more numerous than normative provisions. For example, in Directive 96/9, the preamble contains 60 recitals and only 16 normative provisions. This is a 3.75:1 ratio. This quantitative preponderance of recitals is also observed in other directives. This is an interesting phenomenon against the background of the requirement that the recitals be concise and motivate the individual provisions of the act, while there is no requirement to justify each provision separately. In its judgments in proceedings under Art. 267 of the TFEU in the field of database protection, the EU court generously draws a variety of arguments from the recitals in the preamble of Directive 96/9/EU, which is also seen in other areas and directives. In order to draw more adequate conclusions about the exact role of recitals in the interpretation of EU law, more comprehensive and long-term studies are needed. However, it is clear: recitals should more often be the focus of scholarly interest, not only as a phenomenon unique to EU law. But also to clarify their actual and potential role in relation to their vectors of impact in the legal acts of the Union.

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