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# Strategic Management

and Decision Support Systems  
in Strategic Management

## Proceedings

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## Conference Proceedings

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XXIX International Scientific Conference  
**Strategic Management**  
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 in Strategic Management  
**SM2024**

Subotica (Serbia), 17-18 May, 2024

**Marija Lazarević – Moravčević**  
 Institute of Economic Sciences  
 Belgrade, Serbia

marija.lazarevic@ien.bg.ac.rs

**Marija Mosurović Ružičić**  
 Institute of Economic Sciences  
 Belgrade, Serbia

marija.mosurovic@ien.bg.ac.rs

**Mihailo Paunović**  
 Institute of Economic Sciences  
 Belgrade, Serbia

mihailo.paunovic@ien.bg.ac.rs

## **DIGITAL NOMADS AND THEIR INFLUENCE ON LOCAL ECONOMY DEVELOPMENT**

**Abstract:** Digital nomads are the simplest to describe as professionals who perform tasks independently of location and with the application of digital technology. Those individuals are characterized by a constant search for freedom, an escape from the traditional work environment, autonomy in choosing a destination for life and work. The locations chosen by digital nomads are pleasant environments, i.e. destinations where it is possible to satisfy work, social and financial needs. The purpose of this paper is to analyze the significance of digital nomadism as a global phenomenon. Acknowledging the impact that digital nomads have on the development of the local economy and community, the findings of the paper indicate the role of a strategic approach in creating an attractive environment for their arrival, stay and work.

**Keywords:** digital nomadism, digital nomads, digital technology, destination, impact, economic development

### **1. INTRODUCTION**

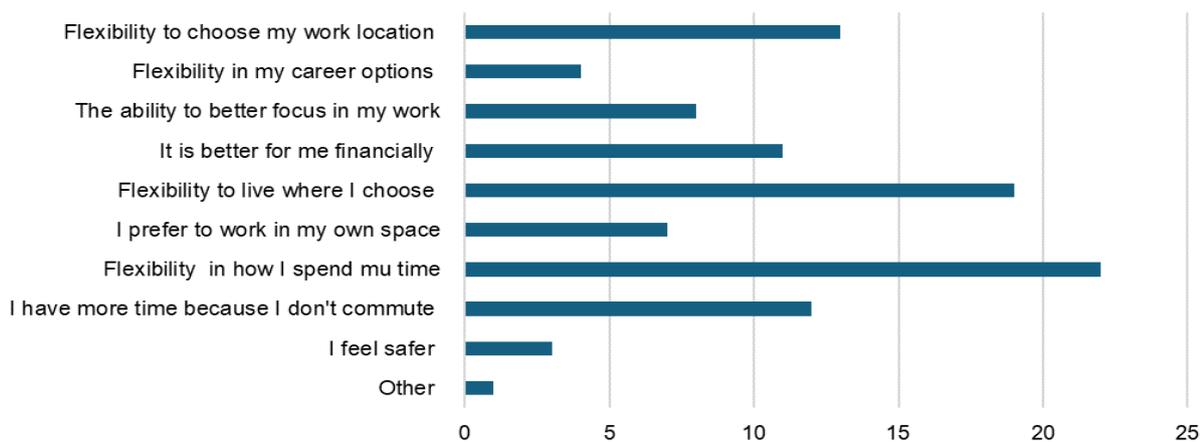
In recent decades, the world of work environment has changed considerably, particularly in terms of the flexibility of working conditions (Demaj et al., 2021). These changes are due to numerous factors, in particular the development of modern information technology and events triggered by the emergence of the COVID-19 virus pandemic. The global crisis in 2020 challenged traditional working practices and showed that many jobs can be carried out regardless of location without compromising productivity. The lessons learned during and after the crisis have significantly changed the mindset of employees both employees and employers. In the current circumstances, remote working is becoming the new standard. To protect the health and safety of employees and keep operations running, many companies are adopting a working model known as 'working from home'. During this period, the location of work activity has shifted away from the office and with the use of modern technology, work is predominantly carried out from home.

This paper focuses on digital nomadism. It refers to a specific type of 'remote work' (Jiwasiddi et al., 2024) that has been on the rise for years and is increasingly shaping the global labor market. Digital nomads are a distinct category of highly mobile workers who should not be equated with traditional remote workers. Both categories of workers rely on modern technologies to carry out their work activities outside the traditional workplace. However, digital nomads also have a unique approach to life and work. They combine work with travel and constantly strive for a balance between work and leisure.

The paper sheds light on the growing trend towards the accelerated development and acceptance of remote working models. The focus emphasis is on digital nomadism and the impact that digital nomads have on the development of the destinations in which they reside. Considering that digital nomads are recognized as a significant tourism segment and that their visits can bring numerous benefits, the paper emphasizes the importance of a strategic approach to attracting this category of workers. The desk research method was used in the study, articles, reports and other relevant publications dealing with digital nomadism serving as data sources. The findings of this paper confirm the increasing role and importance of digital nomads in the development of the local community and can serve as a basis for creating programs to attract this market segment.

## 2. DIGITAL NOMADISM - CHALLENGES AND OPPORTUNITIES

The percentage of employees working remotely is constantly increasing, a trend particularly pronounced during and after the Covid-19 pandemic. Certain studies conducted to examine workers' attitudes toward the new business model indicate a positive perception and experience. Both employees and employers positively evaluated the forced adoption of this business model. According to the State of Remote Work report (2023), the majority of respondents (91%) have a positive opinion of remote work and express a desire to continue with this form of work in the future, at least for some time until the end of their careers. The key reason cited is flexibility, both in terms of choosing how to use their time and selecting a place to live and work. Employees believe that remote work brings other benefits as well. It allows for greater focus on work, more efficient management of stress and time, and avoids unnecessary daily commutes, fewer meetings, and distractions present in offices (Ozimek, 2020). On the other hand, research also confirms that remote work has its shortcomings. Some key issues include feelings of anxiety and burnout. Employees also cite overload as arguments against this approach to work. These phenomena lead to decreased job satisfaction, negatively impact interpersonal relationships, and reduce productivity (McKinsey & Company, 2021).



**Picture 1:** Key benefits of remote work (%)

**Source:** The 2023 State of Remote Work Report, <https://buffer.com/state-of-remote-work/2023>

The global crisis caused by the pandemic has proven that this business model works in many industries and delivers better results than expected. From the employer's perspective, remote working has proven to be a good way to reduce overheads and increase productivity (Harmann & Paris, 2020; Statista 2024). The introduction of this new business model removes geographical barriers to employment and creates the opportunity to find and employ talent regardless of their location (Ozimek, 2020). Due to the numerous benefits, it brings, companies around the world continue to embrace remote working, either fully or through some form of hybrid working model, even after the COVID-19 pandemic.

These factors have had a significant impact on the global labor market. The number of remote workers is constantly increasing. One particularly noticeable trend is the growing number of workers belonging to the digital nomad segment. The term 'digital nomads' mainly refers to young professionals who have replaced office work with work in an online environment. This is a category of highly mobile workers who use modern information technology to carry out their activities regardless of their location. As a rapidly growing class of mobile professionals, digital nomad work also includes international travel on a semi-permanent or continuous basis (Hannonen, 2020). Author Cook (2023) classifies this category of workers into: 1) Freelance digital nomads - individual knowledge workers who freelance while traveling; 2) Digital nomads as business owners; 3) Salaried digital nomads - the fastest growing category; 4) Experimental digital nomads - traveling, working, not earning; 5) Armchair nomads - earning, not yet traveling.

What distinguishes digital nomads from other categories of remote workers is their particular approach to life and work. Digital nomads seek to escape the traditional work environment characterized by standard working hours, hierarchy and constant supervision. For this category of workers, freedom and flexible scheduling are crucial prerequisites for a quality life (Mancinelli, 2020). They find inspiration for innovation and creativity in the flexibility and mobility they enjoy at work (Orel, 2019).

**Table 1:** Types of remote workers

Remote Worker Type	Work and Residence Circumstances
In-country remote worker	Resides in the same country as their employer Never (or rarely) works in the office
Hybrid worker	Resides in the same country as their employer Splits time between working in the office and working remotely.
Digital nomad	Resides in a different country from their employer, and often a third country from their nationality Works purely in a telework fashion.

**Source:** Business Business Advisory Group on Migration (2024).

Digital Nomads and Hybrid Work: [https://www.ioe-](https://www.ioe-emp.org/index.php?eID=dumpFile&t=f&f=159891&token=319e52a2beee5e0e3616a5919f2d1c418db11f0b)

[emp.org/index.php?eID=dumpFile&t=f&f=159891&token=319e52a2beee5e0e3616a5919f2d1c418db11f0b](https://www.ioe-emp.org/index.php?eID=dumpFile&t=f&f=159891&token=319e52a2beee5e0e3616a5919f2d1c418db11f0b)

Digital nomads take numerous factors into account when choosing where to live and work. They usually choose recognizable tourist destinations or pleasant environments with many tourist attractions and favorable working conditions. They always prefer safe and welcoming destinations characterized by a pleasant climate, public services, the presence of a like-minded community, and, above all, optimal internet speed (Sánchez-Vergara, et al., 2023; Mancinelli, 2020; STATISTA, 2022). As they mainly focus on using online tools in their work, internet connection is one of the most important requirements they consider when choosing their location. They often work in public places such as restaurants, cafés and coworking spaces. In addition, the cost of living is one of the most important criteria for choosing a location (STATISTA, 2022; Mancinelli, 2020). Digital nomads primarily choose locations that offer a comfortable living and working environment but cost less. They also choose attractive locations that are rich in leisure and sports facilities. Their focus on sports is not surprising, as digital nomads mostly belong to a younger demographic, usually between 23 and 44 years old (Nomad List, 2024). They are young and energetic people who are constantly on the lookout for adventure and maintain a healthy lifestyle that includes regular physical activities such as hiking, fitness, yoga, swimming, running and cycling (Pumple, 2024).

According to certain estimates, the majority of digital nomads are self-employed, are millennials, have a higher education, earn an average income of between 50,000 and 99,999 US dollars (which varies from country to country), and work up to 40 hours a week (Shewale, 2023). They are predominantly employed in IT - 19%, creative services - 14%, education - 9%, sales and marketing and PR - 9%, finance, and accounting - 8%, and teaching and research - 7% (MBO Partner, 2023).

The significant increase in digital nomadism is confirmed by the fact that the number of digital nomads reached 35 million in 2023. The majority of digital nomads come from the United States, which is estimated to make up 48% of the total digital nomad population. In addition to the United States, most digital nomads come from the United Kingdom (7%), Russia (5%), Canada (5%), Germany (4%), France (3%) and Brazil (2%). In addition, the United States is the destination most frequently chosen by digital nomads (Statista, 2024). In addition to the USA, digital nomads frequently visit Spain, Thailand, the United Kingdom and other countries.

**Table 2:** Most visited cities and countries

Most visited cities	Most visited countries
London	United States
Bangkok	Spain
New York City	Thailand
Berlin	United Kingdom
Lisbon	Germany
Paris	Mexico
Barcelona	France
Amsterdam	Italy
San Francisco	Portugal
Chiang Mai	Indonesia

**Source:** The 2024 State of Digital Nomads. [https://nomadlist.com/digital-nomad-statistics#trip\\_duration](https://nomadlist.com/digital-nomad-statistics#trip_duration)

Compared to traditional remote workers, digital nomads move intensively and can work from virtually anywhere with the help of digital technology (Newland Chase, 2022). Unlike travelers or tourists, they stay longer at their chosen destination. They usually stay at a certain destination for one to two months.

**Table 3:** How long do nomads stay in one city or country

How long do nomads stay in one city	%	How long do nomads stay in one country	%
< 7 days	48	< 7 days	0
3-30 days	33	3-30 days	61
30-90 days	14	30-90 days	26
90+ days	6	90+ days	13
Avaraga - 65 days (2 months)		Avarage – 198 days (6 months)	

Source: The 2024 State of Digital Nomads, [https://nomadlist.com/digital-nomad-statistics#trip\\_duration](https://nomadlist.com/digital-nomad-statistics#trip_duration)

### 3. DIGITAL NOMADISM IN FUNCTION OF LOCAL COMMUNITY DEVELOPMENT

According to certain estimates, 35 million digital nomads worldwide contribute to a global economic value of 787 billion dollars annually. By staying in one place, digital nomads impact the development of the local economy in various ways. Their contribution is particularly evident in the promotion of tourism. Unlike the average tourist, digital nomads stay longer in one place and make extensive use of various services offered by the local population - coworking spaces, cafés, accommodations, and restaurants. Their presence extends the tourist season. According to certain estimates, they spend more money during their stay than the local population and tourists. Through their consumption and use of local services, as well as additional investment, they can also influence the need to create new job opportunities. On the other hand, given the potentially lower costs, employers may prioritize this category of workers and overlook local workers with similar skills (Business Advisory Group on Migration, 2024).

Of course, it should not be overlooked that this segment of the workforce comes from different sectors and brings new knowledge and know-how to the local community, which they share with their surroundings. Digital nomads bring different business and entrepreneurial ideas, are highly creative, and tend to be innovative in their ventures. They often collaborate with local entrepreneurs to initiate joint projects or offer consulting services. They also enrich the social and cultural life of the places they visit (Hall et al., 2019). Digital nomads are in constant communication with the local population. By participating in various local events, they share their experiences, knowledge, and the values on which their culture is based. As they are characterized by a high level of environmental awareness, they pass on their awareness of the importance of environmental protection and natural resources to the local population during their stay. Furthermore, it is important to mention that digital nomads have significant promotional potential. Through their active engagement on various social platforms, they promote the destinations they visit and can thus improve their image.

Based on the above, it can be concluded that the influence of digital nomads goes beyond economic boundaries and spills over into the social and cultural sphere. By staying at a particular destination, digital nomads can stimulate entrepreneurship and support the development of local businesses. Communication with the local population creates opportunities for knowledge transfer, the exchange of ideas and the emergence of innovation.

The analysis of digital nomadism on local community development would entail a multidisciplinary approach encompassing economic, sociological, technological, and cultural aspects. The economic impact of digital nomadism underscores its potential to significantly boost local economies. Digital nomads increase local spending on essentials such as food, accommodation, transportation, and various services. In addition, their presence is often a catalyst for the creation of new jobs. When it comes to local community development, digital nomads bring innovative ideas and contribute to the diversification of industries, ultimately leading to sustainable growth and resilience (Jiwasiddi et al., 2023). The sociological impact of digital nomadism can be seen in the promotion of social inclusion within local communities and the enrichment of diversity by bringing together people from different backgrounds. Their interactions with residents allow for a vibrant cultural exchange that fosters mutual understanding and appreciation for different traditions and perspectives. However, it's important to note that the influx of digital nomads can also lead to shifts in the demographic composition of communities, especially in urban areas with a higher concentration of nomads, which can significantly affect social structures and dynamics (Krivtsova. 2018). The technological impact of digital nomadism on local communities means that the creation of a robust technological infrastructure (high-speed internet, safe working environments) must be prioritized. The development of digital platforms tailored to accelerate collaboration between digital nomads and local entrepreneurs must be encouraged (Santos-Júnior et al., 2020). The cultural impact of digital nomadism points to changes in local culture by introducing new perspectives and lifestyles that may alter traditional norms and behaviors within the community. Furthermore, digital nomads have the potential to promote artistic and cultural endeavors within local communities due to their affiliation with the creative industries. Prioritizing education and training initiatives within local communities facilitates the integration of digital nomads and empowers them with the necessary skills and knowledge to actively contribute to the long-term prosperity of the community. By addressing these two needs, communities can effectively navigate the evolving landscape of digital nomadism while promoting sustainable development and social cohesion.

Considering the multiple impacts they have on the development of the country in which they reside, many countries are seeking to attract a greater number of young, mobile, and skilled professionals. Accordingly, these countries are implementing specific attraction strategies and programs that are carefully tailored to the interests of local populations, nomads, and governments. In an effort to make their destination attractive and suitable for digital nomads, more and more countries are adapting their legal frameworks providing certain incentives to encourage the influx of this category of workers. It is clear that their arrival depends not only on the natural beauty and cultural content but also on the treatment they receive during their stay and the way their status is defined.

Digital nomads usually choose destinations where their status is precisely regulated. In addition, these are usually destinations where special visa regulations apply and certain tax benefits can be claimed. Because of these factors, more and more countries are issuing special visas for digital nomads. This trend has been particularly noticeable during and after the COVID-19 pandemic. These are temporary residence permits for a specific country, which are usually valid for 12 months and can be extended. Compared to tourist visas, visas for digital nomads allow for longer stays and should be easier to obtain. These are documents that grant individuals the right to work and reside outside their home country. According to certain estimates, around 58 countries will introduce this visa practice in 2023. Some of these countries are Spain, Greece, Romania, Hungary, Cyprus, Latvia, Albania, St. Lucia, Grenada, Panama, Belize, Brazil, Ecuador, Dubai, Sri Lanka, Thailand, Malaysia, Namibia, North Macedonia, Serbia, Montenegro, Indonesia-Bali, Italy and Colombia. Visa programs vary from country to country and may only apply to citizens of certain countries or only be available to people working in certain industries.

Visa regime can partially or fully exempt digital nomads from taxes, making the destination country more attractive to this category of worker and more competitive compared to other locations. Tax regulations vary from country to country. According to certain estimates, the countries with the best visas for digital nomads in terms of duration, cost and taxes are Costa Rica, Malta, Anguilla, Croatia, Uruguay, Bermuda, Georgia, Portugal and Spain (Drapkin, 2024).

Digital nomads represent an extremely important tourism segment. The benefits resulting from their stay are numerous. In recognition of these benefits, countries are increasingly competing for the favor of this category of remote workers. In this regard, they are actively operating in different directions and segments. In addition to amending existing laws and complying with legal frameworks, countries are striving to optimize their tourism offer and infrastructure to meet the needs of digital nomads, taking into account that these needs are significantly different from those of business or leisure travelers (Zhou et al., 2024). Essentially, it is about creating a friendly environment in which digital nomads can satisfy their specific needs. It is also known that digital nomads mostly choose destinations where a digital nomad community already exists (Lee et al., 2019). They will certainly not choose a place where there is no community of like-minded people and where they would feel lonely. With this in mind, destinations that plan to become attractive to digital nomads need to focus their efforts on organizing various events (business, but also sports or entertainment) where digital nomads can come together, socialize and work. In this context, coworking spaces where digital nomads come together, work and exchange ideas are of particular importance (Makoza, 2023). Digital nomads are extremely active in the online world. They rely primarily on online communication tools to communicate and share information. Considering their habits and in order to attract this workforce segment more effectively, destinations should intensify their promotional efforts in the online world and target this specific market.

## 4. CONCLUSION

Research in this area points to a new trend - digital nomadism and the impact this phenomenon is having on the development of local economies. Digital nomads represent an extremely mobile category of workers with increasing tendency worldwide from year to year. Through their actions, this category of workers is challenging traditional business models, setting new standards, and stimulating change. The main difference between digital nomads and other remote workers is that they are constantly on the move. Digital nomads work and travel at the same time and choose their location according to different criteria.

Digital nomads have significant impact on local economies around the world. Their presence stimulates local spending, strengthens the tourism industry, promotes entrepreneurship and contributes to the development of the digital economy. However, there are also a number of challenges to overcome, including legal regulations, infrastructure and logistical issues. This phenomenon is becoming increasingly popular among young people and highly skilled workers. By combining flexible work and travel, digital nomads are changing traditional working patterns and placing new demands on economies worldwide, making this topic not only of academic interest but also of great practical importance, especially for local development. By staying in one place, digital nomads contribute to the development of the local environment. Their contribution is particularly evident in the field of tourism. During their stay in a particular place, digital nomads make use of various services and are willing to spend more money on them compared to the local population or the average tourist. In addition, digital nomads exchange experiences, knowledge, and information by interacting with the local population. This category of mobile workers often focuses on collaborating with local entrepreneurs. Joint projects can arise as a result of this collaboration. Through their activities on various social platforms, digital nomads share information and experiences and influence the image of the destination where they are staying. Based on the above, it can be concluded that the contribution of digital nomads to the development of the local

economy goes beyond the economic framework and extends to the social, cultural, and societal dimensions. Given the numerous benefits that can be obtained from their presence, more and more countries are therefore seeking a strategic approach to attracting this category of workers, using various tools and mechanisms in this regard.

The presented research provides a general overview, identifying key factors that may influence digital nomads to choose specific locations. Additionally, it analyzes the benefits and challenges that digital nomads can bring to the development of individual local economies. Considering Serbia's natural potential, future research should focus on examining the impact of digital nomadism on Serbia's development and its positioning in the global context regarding the development of this phenomenon.

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### **Agneš Slavić**

Faculty of Economics Subotica, University of  
 Novi Sad,  
 Subotica, Serbia

agnes.slavic@ef.uns.ac.rs

### **Nemanja Berber**

Faculty of Economics Subotica, University of  
 Novi Sad,  
 Subotica, Serbia

nemanja.berber@ef.uns.ac.rs

### **Maja Strugar Jelača**

Faculty of Economics Subotica, University of  
 Novi Sad,  
 Subotica, Serbia

maja.strugar.jelaca@ef.uns.ac.rs

### **Dimitrije Gašić**

Faculty of Economics Subotica, University of  
 Novi Sad,  
 Subotica, Serbia

dimitrije.gasic@ef.uns.ac.rs

### **Timea Juhász**

Budapest Business University, Faculty of  
 International Management and Business  
 Budapest, Hungary

juhasz.timea@uni-bge.hu

## **THE STUDENTS' PERCEPTION OF THEIR SOFT SKILLS – BASED ON RESEARCH RESULTS FROM HUNGARY AND SERBIA**

**Abstract:** In the 21st century the talented employees and their knowledge and skills are the most important assets of the organizations. In relation to graduated students of economics and management studies employers often value soft skills more than technical and professional skills. Therefore, higher education institutions have a significant role in the advancement of the employability of their students – developing not only their knowledge and professional-technical skills, but soft skills, too. The aim of this paper is to introduce the results of a few international research concerning the role of university-level study programs in the development of the students' soft skills. Besides, the paper presents the results of a questionnaire-based research on the students' perception of the importance and development of soft skills in Hungary and Serbia. Based on the data obtained in 2023 from students of Budapest Business University and Faculty of Economics in Subotica, University of Novi Sad we will show the students' perception of the most important soft skills, their opinion on where the soft skills may be developed, how important is university in developing soft skills and what soft skills may a teacher help to develop. The research hypothesis is that students from Hungary and Serbia have similar perception on the importance and development of soft skills. The IBM SPSS Statistics 26 program is used for statistical analysis. The obtained results may be a useful input for the evolution of university level study programs for students' soft skills development both in Hungary and Serbia.

**Keywords:** soft skills, students' perception, Hungary, Serbia

## **1. INTRODUCTION**

The rapid changes in economic, social, political and technological environment mean a constant challenge for workforce and their competences. In the era of „war for talents” universities have an important role in the improvement of the employability of their students – developing not only their knowledge and professional-technical skills, but soft skills, too.

The industrial revolution 4.0 requires highly competent human resources, therefore universities, as institutions developing the human capital of a nation, are required to not only to training the students and prepare them for work, but to promote the graduates' future personal and career development, too. Higher educational institutions have to develop study programs which prepares students for the changing contexts and complex expectations of the global labour market.

Authors Kember, Leung, and Ma (2007) about seventeen years ago had emphasized that there had been an expanding interest for and recognition of soft skills that can support students to achieve academic and job-related aims upon their graduation. During the last ten years the development of soft skills of the students had become a crucial role in

education. Guerra-Báez (2019) considers that dynamic business environment requires from employees a set of competencies and soft skills such as critical and strategic thinking, problem solving, communication and flexibility. Tang (2019) underlines that higher educational institutions are grounds where scholars get their socialization and develop a variety of knowledge, skills, attitudes, and characteristics that shake the manner they act in a broader society. It is important to highlight that the significance of soft skills depends on the dimensions of organizational and national cultural – there may be significant differences in the importance of various soft skills in different countries and organizations worldwide. But nowadays there are general requirements, too, as the process of globalization and digitalization require the cooperation of employers from different countries and cultures.

The aim of this paper is to introduce the results of a few international research concerning the role of university-level study programs in the development of the students' soft skills. Besides, the paper presents the results of a questionnaire-based research on the students' perception of the importance and development of soft skills in Hungary and Serbia. Based on the data obtained in 2023 from students of Budapest Business University and Faculty of Economics in Subotica, University of Novi Sad we will show the students' perception of the most important soft skills, their opinion on where the soft skills may be developed, how important is university in developing soft skills and what soft skills may a teacher help to develop. The research hypothesis is that students from Hungary and Serbia have similar perception on the importance and development of soft skills. The IBM SPSS Statistics 26 program is used for statistical analysis.

## 2. THEORETICAL BACKGROUND

It is well known that knowledge may be divided into hard skills and soft skills. Asbari et al. (2020) emphasize that hard skills can produce something that is visible, explicit and direct, they can be assessed from technical or practical tests. Escola-Gascon and Gallifa (2022) stress that hard skills are technical competencies specific to a particular discipline or field of work. Hard skills - related to technical aspects to perform several tasks in work, can produce something that is visible, explicit and direct results, can be assessed from technical or practical tests, are easily documented, formed and articulated and usually constitute, knowledge inherent in higher education, can be created, written and transferred between higher education activity units, are traditionally limited to the development and acquisition of formal learning through subjects taught in schools.

There are lots of definitions of soft skills, and they mainly depend on context. Life skills proposed by the World Health Organization, Division of Mental Health which defines them as a set of socio-affective skills that are necessary for interaction with others and that make it possible to cope with everyday demands and challenging situations. The concept of soft skills differs from that of social skills, because social skills are part of soft skills but the latter are additionally formed by skills to learn, analyse, manage time, and innovate. Escola-Gason and Gallifa (2022) underline that soft skills represent psychological attributes that express how people learn, think, and act. Asbari et al. (2020) consider that soft skills form the knowledge that is still in the minds of humans and is highly personal so that transformation requires personal interaction. Kallioinen (2010) highlights that soft skills refer to dynamic, interpersonal psychological attributes that describe a person's different ways of learning, thinking, and acting. The adequate measuring soft skills is important because they are variables that allow students to predict their professional future and career orientation.

There are many classifications of soft skills. One of them, developed by author Robles (2012) differentiate the following groups of soft skills: integrity, communication, flexibility, teamwork, and work ethics, courtesy, responsibility, social skills, positive attitudes, professionalism. On the contrary, author Caeiro-Rodriguez, et al. (2021) based on HERA project developed the following classification: 1) technical skills - related to technical aspects; 2) metacognitive skills - related to the management and improvement of the cognitive process; 3) intrapersonal skills - related to attitude towards things (creativity, adaptability, self-discipline...), 4) interpersonal skills - improve one's capabilities to work with others; 5) problem-solving skills - help to identify the source of a problem and find an effective solution. The attempt to develop acceptable classification of soft skills have two problems: the attributes included in the classifications change depending on the context and type of task to be performed; and in most classifications, the difference between hard and soft skills is not well-defined.

Edeigba (2022) emphasizes that despite of the rising awareness of universities and students about the importance of soft skills there is a significant gap between the students' soft skills and the employers' expectations about soft skills. The differences in skills acquired from universities and the expectations of employers is known as the "expectation gap". The expectation gap is becoming wider because of the rapid changes in the employers' expectations and the impossibility of tertiary education institutions to incorporate these requirements rapidly in the study programs. Author Schulz (2008) underlines that the most missed soft skills are communication skills, business knowledge and project management skills. On the other hand, author Guerra-Báez (2019) thinks that university lecturers have a special responsibility regarding soft skills, because during students' studies lecturers have a significant impact on the development of students' soft skills. Lecturers should be active and practice various soft skills with their students. One of the most effective and efficient way of soft skills development is to include soft skills training into the teaching of hard skills. The advantage of it may be found as more attractive courses and the better success rate of learners. Besides, students have to be very active in this process, too, in order to experience their capabilities, strengths and weaknesses concerning soft skills. There are different approaches for soft skills development, like role-plays or classroom debate.

The literature review shows that the main strategies used to develop soft skills in the tertiary education combine different activities linked to the curriculum that allow practical application.

In case of soft skills development in Hungary the results of Horváth-Csikós, Juhász & Gáspár (2022) support that even if professional knowledge, information technology skills and language are taken as fundamentals, soft skills are also determining. In additions, students emphasize the soft skills that help navigating in the volatile, uncertain, complex, and ambiguous world: resilience in conflicts, teamwork, problem solving skills and communication. The research unfolds a determining friction; namely, that these soft skills are ranked as most influential, but the present education system contributes very little to improve them, as students feel. Moreover, it seems that it is not the formal education system that enables people to acquire soft skills but rather the workplace and informal relations. University internship programs are a good example of the transition between higher education and the labour market and may be an important source of the soft skill development. This would be particularly important to ensure they learn in a real working environment, including professional situations, and acquire management skills that could be utilized at workplaces following graduation. Furthermore, if students find an internship that matches their skills, their employability might increase after graduation. The results of authors Cseh Papp, Molnár and Juhász (2023) conducted among business students in Hungary showed no correlation between the skills students develop during their university education and those during their internship; on the other hand, the correlation between soft skills to be improved in the future workplace and the soft skills acquired at university is only coincidental. The research results also confirmed that internships are not consistently contributing as they should, i.e., give students a hands-on experience of company operations or test and develop the hard and soft skills they have acquired at university. Based on the study findings, it is evident that the perceptions of all stakeholders (university, student, and employer) must be explicitly discussed prior to professional practice to ensure the same expectations from all three parties, making mutual communication and efficient dialogue one of the most crucial factors.

In case of Serbia authors Sretenović, Slavković and Stojanović-Aleksić (2022) stress that in the last few decades, companies – like other organizations world-wide – have to face with constant challenges, such as globalization, competition, IT technologies. Companies need competent and talented employees who have the soft skills which will help them to adopt to the changing business context. Research conducted by Babić and Slavković (2022) in 2011 in Serbia showed that enthusiasm, teamwork, flexibility and communication skills are the highly ranked soft skills that managers from all sectors expect from their employees. The research of Milić et al. (2023) on perception of engineering students in Serbia has shown that when it comes to the importance of various soft skills needed for future careers, students rated team work and communication skills as the most important, and creativity and leadership as the least important soft skills. When students rated their own levels of soft skills, problem solving and flexibility/adaptability were rated with the highest scores, while presentation skills and stress management were ranked lowest. The results show that students are becoming more aware of the importance of non-technical skills. But there is still a gap between the importance level of skills needed for future work and the level of student's self-assessment of soft skills. The results suggest that educational institutions, professors, students and companies have to cooperate in order to succeed and develop students' hard and soft skills.

### **3. RESEARCH METHODOLOGY**

In order to analyse the students' current perception on their soft skills a questionnaire-based field research was conducted on the importance and development of students' soft skills in Hungary and Serbia. In Hungary the questionnaire was filled out mainly by business students of Budapest Business University, while in Serbia the participants were students of Faculty of Economics in Subotica, University of Novi Sad. The on-line anonymous questionnaire was filled out by university students of all levels (bachelor, master and PhD students) from October 2022 till March 2023. The number of respondents from Hungary was 661, while from Serbia it was 245. The research was focusing on students' perception of the most important soft skills and their opinion on how important is university in developing soft skills. The questionnaire consists of 19 questions about the demographic characteristics of the respondents, the degree of development of soft skills and the importance of soft skills for the labor market. The following 22 soft skills were analyzed in the survey: professional skills, language skills, IT skills, communication, good communication skills, appearance, time management, critical thinking, leadership skills, entrepreneurial skills, ability to work in teams, ethical and moral skills, strategic thinking, time management skills, planning and organizational skills, presentation skills, self-awareness, problem solving skills, empathy, creativity, flexibility, stress management and emotional intelligence. The surveyed students answered on a five-point Likert scale from completely agree (the most important) to completely disagree (not important at all).

The research hypothesis is as follows:

H1: There is a statistical significant difference in the importance of soft skills depending on whether the students are from Hungary or Serbia.

H2: There is a statistical significant difference in the development of soft skills depending on whether the students are from Hungary or Serbia.

The set hypotheses were analyzed using the independent t test within the SPSS program.

Concerning the sample overview, we have to highlight that in Hungary about half of the respondents (about 55 %) were female, while in Serbia the great majority of represents (80%) were female. The respondents' age distribution shows that the in Serbia great majority (96%) of respondents is between 21 and 29 years, while in Hungary the majority (72%) have less than 20 years. This difference may be caused by the different education systems, as in Serbia children begin the elementary school with 7 years, not with 6 as it us the case in Hungary. In Hungary the great majority (91%) of respondents have secondary school education, i.e., they are bachelor level students, while in Serbia the two thirds (66%) of the interviewees are master students, with college or university education, while one thirds of respondents are undergraduate students. This structure does not represent the institutions student structure of the analysed institutions. In Hungary students with work experience dominate the sample, while in Serbia the majority (57%) of analysed students have no experience. These differences point out to the differences in the education system and the labour market position of students in the analysed countries.

## 4. RESULTS AND DISCUSSION

Before testing the hypotheses we analyzed some important attitudes of the surveyed students from Hungary and Serbia using descriptive statistics and made a comparison.

In the questionnaire-based research interviewees were asked to identify the most important soft skills the employers expect from a candidate with a university education and to value how they meet these requirements concerning the soft skills. A five-point Likert scale was used to document the answers. Table 1 presents the students' perception about the ten most important skills employers expect from university graduates in Hungary and Serbia and their perception on how they meet these expectations. The means and the standard deviation data are presented.

**Table 1.** The respondents' perceptions about the most important soft skills  
(1- not important at all 5-the most important)

The most important skills	Students' perception on employers' expectations from candidates with tertiary education		Students' perceptions on the level of their soft skills	
	Hungary (Mean)	Serbia (Mean)	Hungary (Mean)	Serbia (Mean)
Communication skills	4.76	4.46	4.14	4.28
Good communication skills	4.56	4.48	4.11	4.38
Language skills	4.55	4.48	4.13	3.77
Ability to work in team	4.56	4.4	4.27	4.29
Planning and organizational skills	4.55	4.37	3.82	4.27
Problem solving	4.37	4.34	4.08	4.04
Flexibility	4.39	4.33	4.10	4.26
Presentation skills	4.24	4.26	3.50	3.96
Creativity	4.27	4.19	3.89	4.01
Time management	4.1	4.39	3.73	4.02

**Source:** Own research

According to the obtained data students both from Hungary and Serbia consider that employers expect from university graduates the following skills: communication skills, language skills, teamwork, planning and problem solving, flexibility and creativity. Based on the students' self-evaluation they have the highest level of teamwork skills, flexibility, communication skills, planning and organization skills. The students consider that they have lower level of presentation skills and time management skills. Students assume that they meet the employers' requirements the best concerning their ability to work in teams and flexibility.

Table 2 presents the data on respondents' opinion about importance of soft skills and how education develop soft skills.

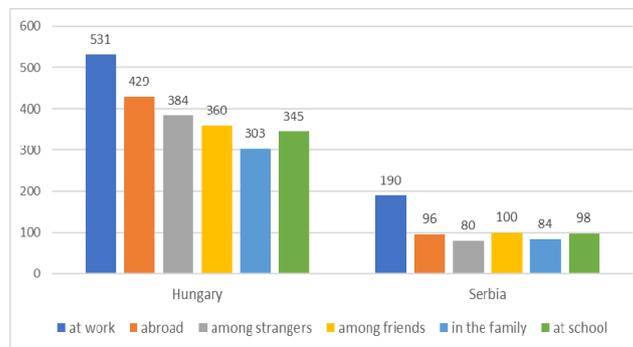
**Table 2.** The respondents' perceptions on importance and development of soft skills (1- not important at all 5-the most important)

Statements about soft skills	Students' agreement (1-5)	
	Hungary	Serbia
Soft skills are more important in today's labour market than technical skills	3,74	4,09
Soft skills can be learned at school	3,13	3,08
Education prepares students for the challenges of the labour market.	2,41	3,09

**Source:** Own research

Students consider that for employability soft skills are very important - equally or more than hard skills – but do not think that soft skills can be learned at school and education fully prepares them for work. The figure 1 shows the Respondents' perception on where they can improve their soft skills.

**Figure 1.** The respondents' perceptions on where they can improve their soft skills

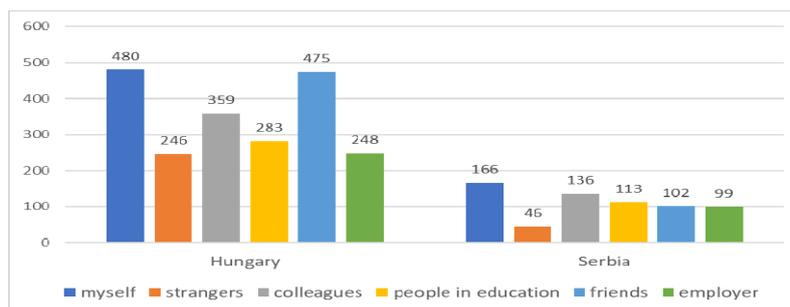


**Source:** Own research

The data presented in figure 1 show that students from Hungary and Serbia both think that they can mainly develop their soft skills at work or abroad.

Figure 2 represent the obtained data on the respondents' perception on who may influence the development of their soft skills.

**Figure 2.** The respondents' perceptions on who may influence the development of their soft skills



**Source:** Own research

In Hungary the students consider that they themselves and friends have the most important influence on the development of soft skills, while in Serbia students think that they and their colleagues have the most important influence on the development of soft skills. According to the interviewed students, people in education do not have important influence in that process.

For the Hypothesis testing we used Independent t test in the software SPSS. The table 3 and 4 shows the results of the Hypothesis testing.

**Table 3.** County influence on importance and development of soft skills

Group statistics	Country	N	Mean	Std. Deviation	Std. Error Mean
	Importance of soft skills	Hungary Serbia	661 245	2.6378 4.1472	.35671 .52454
Development of soft skills	Hungary Serbia	661 245	3.8612 4.0095	.42741 .52565	.01662 .03358

**Source:** Own research

**Table 4.** Results of Independent t test

Independent Sample Test		Levene's Test for Equality of Variances		T-test for Equality of Means				
		F	Sig.	t	df	Sig (2-tailed)	Mean Difference	Std. Error
Importance of soft skills	Equal variances assumed	43.992	.000	49.356	904	.000	1.50938	.03058
	Equal variances not assumed			41.614	331.220	.000	1.50938	.03627
Development of soft skills	Equal variances assumed	13.141	.000	4.348	904	.000	.14830	.03411
	Equal variances not assumed			3.958	370.028	.000	.14830	.03747

**Source:** Own research

Using Individual t test, it was determined that there is a statistically significant difference between the students from Hungary and from Serbia regarding the importance of soft skills from the angle of labor market. As authors Caggiano, Schleutker, Petrone, & Gonzalez-Bernal stated that „students' soft skills are adapted to the needs of the socioeconomic environment“, it is to be expected that there are differences (2020, p. 4031). Furthermore, it was determined that there is a statistically significant difference between the students from Hungary and from Serbia regarding the development of soft skills. The reason for such a result could be that the soft skills competences are not acquired in the same level at university from different countries because there are differences in curricula design framework and even in EU countries (Cinque, 2016). For example, in some EU countries this topic is very important while in other is still emerging and is in the process of development (Cinque, 2016).

## 5. CONCLUSION

The industrial revolution 4.0 requires highly competent employees who have professional competences and soft skills to successfully cooperate in the global business context. The development of soft skills during a formal tertiary education is challenging as soft skills form the knowledge that is in the minds of humans and is highly personal so that transformation requires personal interaction. A more efficient way of offering soft skills training to students is to embed it into the teaching of hard skills. But it may be reflected in the lecturers' teaching methodology requiring some re-thinking and redesign of existing hard skill courses.

The results of the research on the students' perception of the importance and development of soft skills in Hungary (Budapest Business University) and Serbia (Faculty of Economics Subotica – University of Novi Sad) show that students consider that employers expect from university graduates the following skills: communication skills, language skills, teamwork, planning and problem solving, flexibility and creativity. Based on the students' self-evaluation they have the highest level of teamwork skills, flexibility, communication skills, planning and organization skills. Students consider that soft skills may be only partially learned at universities.

We have to take into account the differences between labour market conditions in different countries. Furthermore, the structure of job occupations between countries are different as well as university curricula design which should be in the

line of such specific conditions. That is why in our empirical study we determined that there is statistically significant difference between importance as well as development of soft skills between students from Hungary and Serbia. Based on the above it may be concluded that the importance of tertiary education in developing soft skills in Serbia is moderate. The limitation of the research is the different sample size and structure from Hungary and Serbia. Future research has to focus on more representative sample from both countries to test if the differences in results are due to the different student perception or due to the different educational system and structure of students.

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**Tamara Jevtić**

Academy of Professional Studies Šabac,  
 Šabac, Republic of Serbia

**Dimitrije Gašić**

Faculty of Economics in Subotica, University  
 of Novi Sad, Republic of Serbia

tamarajevtic@vmpts.edu.rs

dimitrije.gasic@ef.uns.ac.rs

## THE EFFECTS OF HIGH WORK INVOLVEMENT ON THE WELL-BEING OF IT SECTOR EMPLOYEES IN THE REPUBLIC OF SERBIA

**Abstract:** In the modern business environment, organizations focus on strategies and concepts that are in the domain of social responsibility, with the aim of strengthening their competitive position on the market. This paper deals with human resource management concepts based on new models, such as high employee involvement and employee well-being. The main goal of this research was to examine the relationship between high work involvement and employee well-being. The main research question relates to determining the effect that high work involvement causes on the well-being of employees. The theoretical and empirical part of the research is the methodology of the work. As part of the theoretical part of the research, an overview of the author's previous research on the topic of high work involvement and employee well-being was carried out. Empirical research was conducted on a sample of 100 employees (managers and professional workers) in organizations operating within the IT sector in the Republic of Serbia. The collection of the sample lasted during January 2024 through an electronic questionnaire. Using the PLS-SEM method within the Smart PLS software, the proposed relationship was tested. The results of the research indicated that there is a direct positive effect of high work involvement on the well-being of employees. Employees who are involved in making decisions, solving problems and proposing new ideas will have more developed mental, psychological and emotional aspects of life.

**Keywords:** high work involvement, well-being, social responsibility, IT sector, Republic of Serbia

### INTRODUCTION

In the past few decades, the Information Technology (IT) sector has experienced remarkable growth and development worldwide, becoming one of the key branches of the modern economic system. The Republic of Serbia is no exception to this trend on the contrary, it has been witnessing an increasing growth and significance of the IT sector in its economy. Interest in employees in the IT sector has been steadily rising over time. Recently, with the growing number of companies in the IT sector, there has emerged a need to explore the relationships within these organizations that contribute to the motivation, dedication, and increased productivity of employees.

High work involvement plays a crucial role in organizational development, as well as in enhancing the organizational performance of employees. It enables the exchange of information among employees and helps them understand the mission and vision of the organization, as well as the organizational culture, signaling to workers to respect each other, value their contribution to the organization, and thus improve their satisfaction and motivation (Ahmad et al., 2014). Employee well-being or psychological well-being, or the effectiveness of an individual's psychological functioning, is related to primary aspects of life such as work, family, and society (Wadhawan, 2016; Lee & Kim, 2023).

The aim of this research is to examine the relationship between high work involvement and employee well-being in the IT sector of the Republic of Serbia. The research subject is to determine the effect that high work involvement has on the well-being of employees.

# 1. THEORETICAL BACKGROUND

## 1.1. High work involvement and well-being of employees

High work involvement plays a crucial role in organizational development and in enhancing the organizational performance of employees. As emphasized by Wood and Ogbonnya (2018), it has historically been used as a means to overcome economic crises both at the organizational and national levels. High work involvement enables the exchange of information among employees and helps them understand the mission, vision, and organizational culture, signaling to workers to respect each other, value their contribution to the organization, thus improving their satisfaction and motivation (Ahmad et al., 2014). According to Kilroy, Flood & Bosak (2016) and Törnross, Salin & Magnusson Hanson (2020), high work involvement practices are designed to increase employees' empowerment, information, motivation, and skills. Nasurdin, Ling & Khan (2018) derive the concept of high work involvement from human resource management, where organizations encourage employees to contribute to organizational processes, recognizing them as vital drivers of organizational success. Employees are encouraged to make decisions and solve problems, propose new ideas and constructive solutions, delegate responsibility and authority to them, and are assured that the organization trusts them. The benefits of employee participation include being a sound business move and an effective instrument for harnessing employee creativity. From an economic standpoint, the cheapest and most effective method of motivation is high work involvement—employees will be more interested in their work if they are involved in decision-making processes and will feel a greater sense of belonging to the organization. According to scholars in this field (Kim & Sung-Choon, 2013; Guerrero & Barraud-Didier, 2014; Rana, 2015; Jekić, 2015; Wood & Ogbonnaya, 2018), high involvement management encompasses four main attributes: power (employees have the power to make decisions and participate in decision-making processes), information (employees exchange information), employees are rewarded, and they are provided with training to acquire necessary knowledge and skills. When these four attributes are applied together, they impact employee productivity and organizational performance positively. Employees in organizations that encourage the implementation of high involvement gain more skills for performing their tasks correctly, more information to rely on when making effective decisions. Different researchers have used various practices to measure high involvement management, including selecting the right person for the right job, training programs, and teamwork. If high involvement management is applied, it can stimulate positive feelings in the minds of employees about their work. High involvement management is considered a key finding of modern management that has a strong impact on individual employee performance and the organization itself (Ahmad et al., 2014).

In the contemporary business environment, managing the mental aspects of organizational members involves emotional labor, mental stress, and balancing work and life, becoming increasingly important according to Lee and Kim (2023). Literature analysis indicates that there is no clear definition of employee well-being. A person is said to have high psychological well-being when they are satisfied with life and experience positive emotions while avoiding negative emotions (anger, negativity, and depression). Contemporary organizations expect their employees to be proactive, take responsibility, and be committed to achieving the organization's goals. Employee performance, and therefore job satisfaction, is not possible without individual psychological well-being (Wadhawan, 2016). For employees, the level of well-being is associated with how satisfied they are with their work and how the organization treats them. It is emphasized that well-being supports and enhances greater employee involvement, and thus organizational performance and competitive advantage. According to Popescu et al. (2022), there are three main aspects of well-being: psychological, physical, and social. Psychological well-being focuses on individuals' subjective experiences, while physical well-being relates to objective physiological measures and subjective experiences of physical health. Social well-being concerns the quality of relationships with other people. Well-being is measured by objective indicators, individual perception assessment, questionnaire completion, conducting interviews, or direct observation of individuals (Popescu et al., 2022).

### 1.1.1. Relationship between high work involvement and well-being of employees

According to Bakker (2008), high work involvement can improve employees' psychological well-being by providing them with a sense of purpose and meaning in their work. When employees are emotionally engaged in their tasks, this can result in greater satisfaction and positive emotions in the workplace. Work involvement can also indirectly impact the physical well-being of employees. When employees are emotionally engaged in their work, it can reduce stress levels and improve overall health, contributing to better physical well-being. Job satisfaction, often stemming from high work involvement, can contribute to better interpersonal relationships among employees. A positive work environment can increase feelings of belongingness and support among colleagues, which positively influences social well-being. Vanhala, Von Bonsdorff & Janhonen (2009), Wood & Menezes (2011) determined that high work engagement has positive effects on employee well-being.

Based on the subject and aim of this study, and considering previous research on this topic, the main hypothesis to be tested is as follows:

***H: High work involvement leads to positive effects on the well-being of employees in the IT sector in Serbia.***

## 2. METHODOLOGY

In this section, the sampling procedure, the method through which participants had the opportunity to respond to questions, the timeframe for sample collection, as well as the presentation and description of the sample will be presented.

### 2.1. The questionnaire

During the research on the effects of high work involvement on the well-being of employees, an electronic questionnaire "Google Forms" was used, consisting of two parts. The first part of the questionnaire included control questions such as gender, age, level of education, position in the organization, organization size, market served by the organization, work experience, and work patterns. The second part of the questionnaire pertained to the assessment of high work involvement of employees as the independent variable and employee well-being as the dependent variable. The works of the authors Yang (2012) and Zheng et al. (2015) were used to create the second part of the questionnaire. For the purposes of research and measurement, a Likert scale was used, ranging from 1 to 5, where 1 represents "strongly disagree"; 2 "disagree"; 3 "neutral"; 4 "agree"; and 5 "strongly agree" (Joshi, Kale, Chandel & Pal, 2015). The questionnaire link was distributed exclusively to employees in the IT sector in the Republic of Serbia.

### 2.2. Sample characteristics

The questionnaire relating to the effects of high work involvement on the well-being of employees was exclusively intended for managers and skilled workers (software engineers) in the IT sector in the Republic of Serbia. The created questionnaire was completed by 100 employees, including managers and skilled workers in the IT sector in the territory of the Republic of Serbia. The sample collection lasted throughout January 2024. Table 1 illustrates the sample structure according to gender, age, level of education, position of the employee in the organization, organization size, market served by the organization, work experience, and work patterns. The sample consisted of a higher representation of male respondents (58%), younger employees aged 18 to 25 (48%), with completed four-year academic studies (39%), in the position of skilled workers - software engineers (67%). The sample predominantly comprised employees in small organizations (45%) serving the international market (31%). In the sample structure, employees' work experience ranged from 1 to 5 years. The most dominant work pattern within the observed sample was a hybrid work model, combining work from home and office-based work (49%).

**Table 1:** Sample characteristics

Sample characteristics	Number of respondents	Percentage (%)
<b>Gender</b>		
Male	58	58
Female	42	42
<b>Age structure</b>		
18 – 25	48	48
26 – 30	30	30
31 – 35	10	10
36 – 40	4	4
41 – 45	5	5
46 – 50	2	2
More than 50	1	1
<b>Level of education</b>		
High school	11	11
Three years of vocational studies	33	33
Beachelor's deree	39	39
Master's study	14	14
Ph.D.	3	3
<b>Position in company</b>		
Manager	33	33
Professional worker (software engineer)	67	67
<b>Size of the organization</b>		
Micro	6	6

Small	45	45
Medium	28	28
Big	21	21
<b>Target market</b>		
Locally	8	8
Regionally	15	15
Nationally	17	17
Internationally	31	31
Globally	29	29
<b>Work experience</b>		
Less than one year	14	14
1 – 5 years	58	58
6 – 10 years	18	18
11 – 15 years	4	4
16 – 20 years	3	3
More than 20 years	3	3
<b>Work form</b>		
Fully office work	35	35
Hybrid work model	49	49
Completely out of the office	16	16

Source: The authors' research

### 3. RESULT AND DISCUSSION

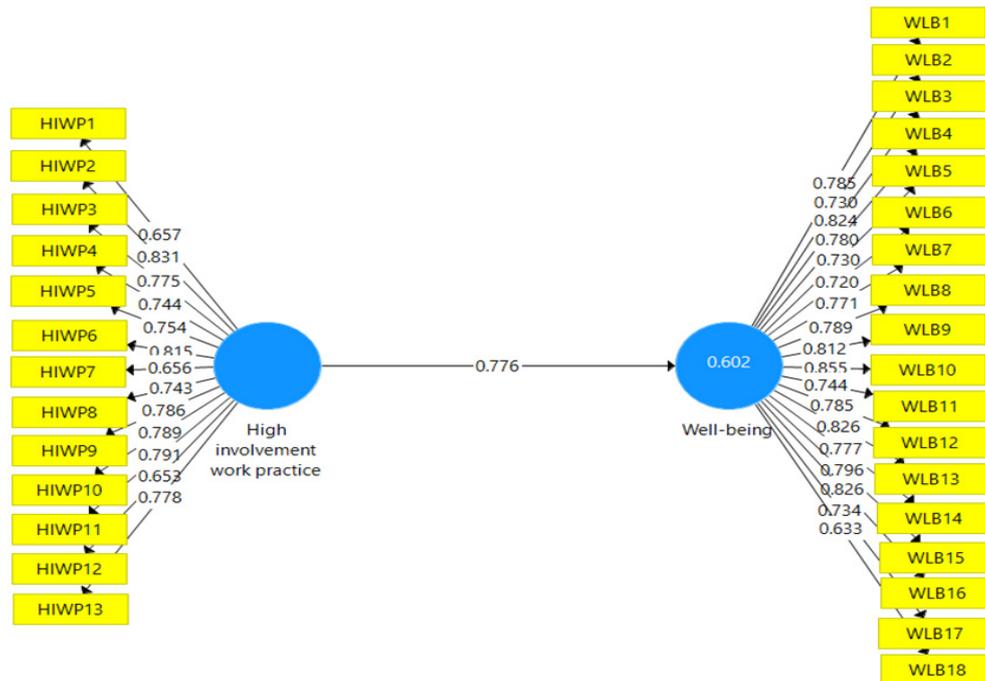
To present the results of the research on the effects of high work involvement on employee well-being, statistical software such as "SPSS IBM" and "Smart PLS" was utilized. A Partial Least Squares Structural Equation Modeling (PLS-SEM) analysis was conducted to adequately determine the effect between the research variables. The study aimed to ascertain the direct impact of high work involvement on employee well-being. Table 2 displays the descriptive statistics for the two observed variables.

**Table 2:** Descriptive statistics for observed variables

	Number	Minimum	Maximum	Mean	Std. Deviation
<b>High involvement work practice</b>	100	1,62	4,18	3,1937	0,56
<b>Well-being</b>	100	1,53	5,00	4,0676	0,75

Source: The authors' research

The results of measuring the reflective constructs within the established model are presented in the first part of the analysis, where the external loadings of indicators for each variable in the model were analyzed, along with reliability, convergent validity, and discriminant validity. Table 3 displays the external loadings of indicators for each variable in the observed model. According to Berber, Slavić & Aleksić (2020), loadings below 0.708 should be excluded from further analysis. As per Jevtić & Gašić (2024), loadings between 0.4 and 0.7 should be retained in the model only if they do not disrupt other indicators. After analysis, all indicators passed the test, with all indicators having loadings above 0.4.



**Figure 1:** Path coefficient estimates  
 Source: The authors' research

**Table 3:** Reflective indicator loadings

Items	High involvement work practice	Well-being
HIWP1	0,657	
HIWP2	0,831	
HIWP3	0,775	
HIWP4	0,744	
HIWP5	0,754	
HIWP6	0,815	
HIWP7	0,656	
HIWP8	0,743	
HIWP9	0,786	
HIWP10	0,789	
HIWP11	0,791	
HIWP12	0,653	
HIWP13	0,778	
WLB1		0,785
WLB2		0,730
WLB3		0,824
WLB4		0,780
WLB5		0,730
WLB6		0,720
WLB7		0,771
WLB8		0,789
WLB9		0,812
WLB10		0,855
WLB11		0,744
WLB12		0,785
WLB13		0,826
WLB14		0,777
WLB15		0,796
WLB16		0,826
WLB17		0,734
WLB18		0,633

Source: The authors' research

Reliability and convergent validity are presented in Table 4 and measured using Chronbach's alpha, composite reliability, and average variance extracted (AVE). According to Hair, Hult, Ringle & Sarstedt (2014), the threshold value for Chronbach's alpha is 0.60, achieving convergent validity for all constructs in the model. According to Hair, J. F., Hult, G. T. M., Ringle, C. M., & Sarstedt, M. (2017), the threshold value for composite reliability is 0.70. For each construct in the model, composite reliability exceeds 0.90. The extracted average variance is greater than 0.50, as indicated by Jevtić & Gašić (2024) and Gašić & Berber (2021).

**Table 4:** Internal consistency and convergent validity

	Cronbach's alpha		Composite reliability		Average variance extracted (AVE)	
	Values	Criterion	Values	Criterion	Values	Criterion
High involvement work practice	0,936	>0,60 (Hair et al. 2014)	0,944	>0,70 (Hair et al. 2017)	0,568	>0,50 (Gašić & Berber, 2021; Jevtić & Gašić 2024)
Well-being	0,961		0,964		0,600	

Source: The authors' research

Discriminant validity can be assessed based on cross-loadings analysis, Fornell-Larcker criterion, and HTMT (Berber et al., 2022). Cross-loadings analysis is presented in Table 5. The proposed model has adequate discriminant validity if each indicator of a specific construct is weakly correlated with other constructs (Grubor, Đokić, Milićević, Đokić, 2021). Certain indicators (HIWP2, HIWP5, WLB7, WLB8, WLB 10, WLB12) were excluded from the constructs due to incomplete fulfillment of the cross-loadings criterion. This decision was made to ensure the discriminant validity of the constructs and the reliability of the analysis results. The excluded indicators did not show adequate correlation with their primary constructs, which could lead to biased or invalid results. Therefore, these indicators were eliminated from further analysis to preserve the accuracy and reliability of the results.

**Table 5:** Discriminant validity – Cross-loadings

	High involvement work practice	Well-being
HIWP1	0,646	0,644
HIWP3	0,767	0,583
HIWP4	0,722	0,524
HIWP6	0,812	0,500
HIWP7	0,667	0,494
HIWP8	0,774	0,427
HIWP9	0,794	0,525
HIWP10	0,806	0,525
HIWP11	0,797	0,546
HIWP12	0,689	0,275
HIWP13	0,789	0,499
WLB1	0,483	0,806
WLB2	0,515	0,758
WLB3	0,518	0,852
WLB4	0,559	0,770
WLB5	0,470	0,730
WLB6	0,525	0,780
WLB9	0,629	0,701
WLB11	0,504	0,777
WLB13	0,586	0,839
WLB14	0,596	0,790
WLB15	0,565	0,801
WLB16	0,573	0,849
WLB17	0,537	0,758
WLB18	0,423	0,681

Source: The authors' research

If the loading of the first construct is higher than that of the second construct, the Fornell-Larcker criterion is fulfilled. Based on Table 6, it can be concluded that discriminant validity has been achieved according to the Fornell-Larcker criterion.

**Table 6:** Discriminant validity – Fornell – Larcker criterium

	High involvement work practice	Well-being
High involvement work practice	0,754	
Well-being	0,691	0,780

Source: The authors' research

If there are certain deviations regarding discriminant validity, they can be overcome using the HTMT approach, which is the most accurate indicator of discriminant validity. The threshold value for HTMT is 0.90 (Hensler, Ringle & Sarsted, 2015). In Table 7, the displayed value is below 0.90, indicating that discriminant validity has been achieved according to this criterion.

**Table 7:** Discriminant validity – Heterotrait-monotrait – HTMT

	High involvement work practice	Well-being
High involvement work practice		
Well-being	0,709	

Source: The authors' research

The results of multicollinearity analysis are presented in Table 8. According to Shams, Niazi & Asim (2020) the limit value is 5, while Hair, Risher, Sarstedt & Ringle (2019), values for VIF below 10 are accepted, based on which all values in Table 8 are acceptable.

**Table 8:** Multicollinearity testing of indicators – VIF

Items	VIF
HIWP1	1,737
HIWP3	2,250
HIWP4	1,989
HIWP6	2,749
HIWP7	1,897
HIWP8	2,986
HIWP9	3,808
HIWP10	3,377
HIWP11	2,797
HIWP12	3,520
HIWP13	4,003
WLB1	3,142
WLB2	2,716
WLB3	4,369
WLB4	2,374
WLB5	2,648
WLB6	3,407
WLB9	3,547
WLB11	2,282
WLB13	3,996
WLB14	3,141
WLB15	3,469
WLB16	4,382
WLB17	3,149
WLB18	2,576

Source: The authors' research

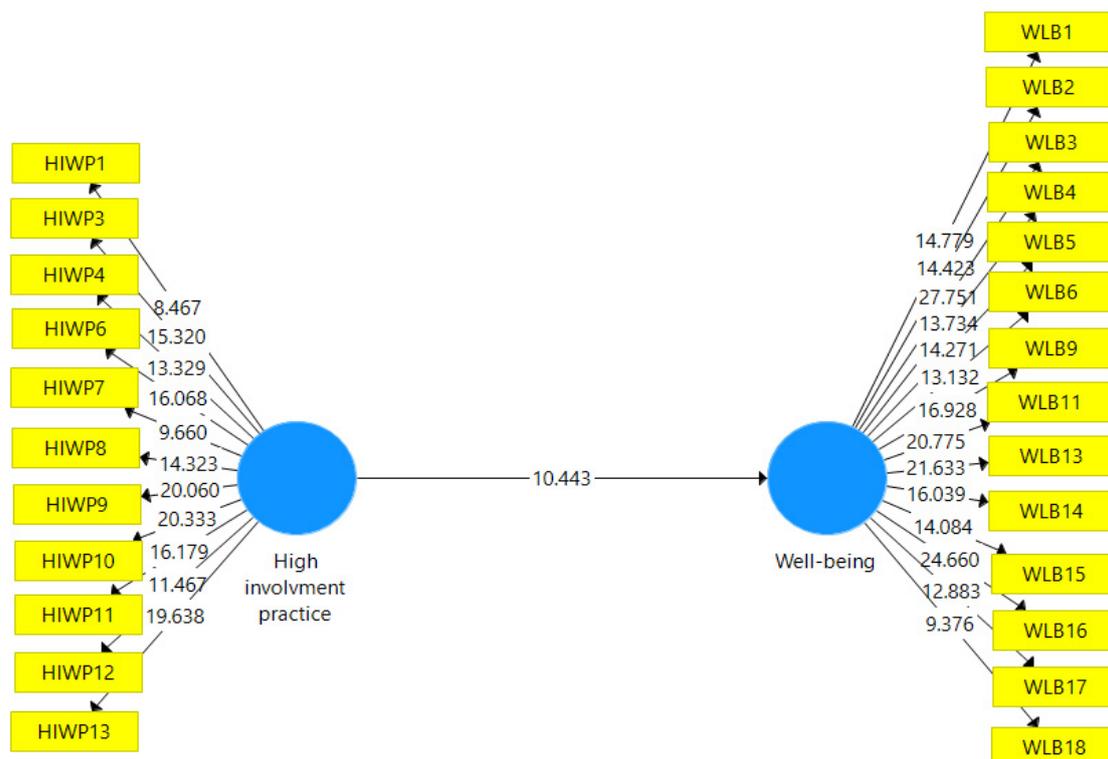
The analysis of the relationship between the independent and dependent variables, namely high employee work involvement and their well-being, is presented in the final step.

**Table 9:** Statistical significance testing – direct and specific (mediator) indirect effect

	Original sample	St. deviation	T statistics	p-values	Hypothesis
High involvement work practices → Well-being	0,691	0,066	10,443	0,000	H: Accepted

Source: The authors' research

In Table 9, the standard deviation, t-statistic, and p-value are displayed. Based on the results obtained, it can be concluded that there is a statistically significant positive relationship between high employee work involvement and well-being ( $\beta = 0.691$ ,  $t = 10.443$ ,  $p = 0.000$ ). The research results indicate that high employee work involvement has a positive effect on employee well-being. Therefore, based on the conducted research, it can be concluded that there is a direct, positive, and statistically significant impact of high employee work involvement on employee well-being. Our research findings clearly confirm the hypothesis of the existence of a direct positive relationship between high employee work involvement and employee well-being. These findings suggest that organizations that strive for a high level of employee involvement, particularly through decision-making processes, problem-solving, and support for innovation, can expect improvement in the mental, psychological, and emotional well-being of their employees. This is crucial considering that employee well-being is increasingly recognized as a key factor in achieving organizational goals, including productivity, employee loyalty, and client satisfaction. It is important to emphasize that our findings are consistent with theoretical propositions about the relationship between work involvement and employee well-being. The theoretical framework we used provided the basis for understanding this relationship, but our empirical research added concrete support to this theory in the context of the IT sector in Serbia.



**Figure 1:** The path model with bootstrapping results  
**Source:** The authors' research

## CONCLUSION

Based on the conducted research on the relationship between high employee work involvement and employee well-being in the IT sector in Serbia, important conclusions can be drawn that contribute to understanding this key aspect of human resources in the contemporary business environment.

The research confirmed the existence of a direct positive relationship between high employee work involvement and employee well-being. The results clearly demonstrated that employees who are involved in decision-making processes, problem-solving, and proposing new ideas have more developed mental, psychological, and emotional aspects of their lives. This confirms the significance of human resource management strategies based on new models, such as high employee work involvement, in achieving employee well-being. As in the works of the authors of Vanhala, Von Bonsdorff & Janhonen (2009), Wood & Menezes (2011), it is concluded that there is a positive effect of high work involvement on the well-being of employees.

In the modern business world, organizations increasingly recognize the importance of social responsibility and caring for the well-being of their employees. Our research provides additional support to this trend, emphasizing that investing in strategies that encourage high employee work involvement can have a positive impact on employee well-being. This is not only a moral obligation of organizations towards their employees but also a strategic approach that can strengthen

their competitive position in the market. The results of our research highlight the importance of developing human resource management strategies that promote high employee work involvement as a key factor in improving employee well-being. This is not only beneficial for the organization itself but also for the broader community, contributing to the creation of a more productive, satisfied, and harmonious work environment.

Although we used valid methods for data collection and analysis, a sample of 100 employees may be relatively small and specific to the IT sector in Serbia, limiting the generalizability of our findings. Further research could expand the sample and consider other sectors and geographic locations to obtain more generalizable conclusions.

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**Milica Stanković**  
 General Hospital "Sveti Luka"  
 Smederevo, Republic of Serbia

mstankovickosta@gmail.com

**Marko Slavković**  
 University of Kragujevac Faculty of  
 Economics  
 Kragujevac, Republic of Serbia

msslavkovic@kg.ac.rs

## **DOES EMPLOYER BRANDING MATTER IN HEALTHCARE ORGANIZATIONS? PERCEPTION OF HEALTHCARE WORKERS IN THE REPUBLIC OF SERBIA**

**Abstract:** Attracting and retaining high-quality employees is the ultimate task of healthcare organizations in order to achieve their mission of providing quality healthcare services. Building a strong employer brand can not only reduce the turnover rate, but also make the healthcare organization a desirable place to work. Accordingly, the aim of the paper is to identify the perception of healthcare workers about the employer brand of healthcare organizations in the Republic of Serbia. The research results show a significant gap for the development of the employer brand in healthcare organizations.

**Keywords:** Employer brand, Healthcare organization, Healthcare professionals

### **INTRODUCTION**

The healthcare system is becoming increasingly complex, and the success of a healthcare organization depends on the quality of services provided. Provisioning healthcare services becomes challenging due to a shortage of human resources, especially in terms of the number of nurses. The lack of qualified healthcare workers is the most significant challenge healthcare organizations are facing today. Despite population growth, there are not enough educated workers capable of responding adequately to the rapid increase in demand for healthcare services (Balakrishnan et al., 2022). To improve the quality of provided healthcare services, employer branding in healthcare has become an integral part of successful employment strategies for healthcare organizations. Today, employer branding is recognized as a key resource for attracting and retaining high-quality employees in an era where the battle for talent is ongoing (Elving, Westhoff, Meeusen & Schoonderbeek, 2013).

In the healthcare system, there is an increasing level of employee turnover, and the outflow of qualified healthcare workers is becoming more pronounced, which leads to serious operational problems. Consequently, healthcare organizations more frequently need to hire new personnel. Overcoming the problems arising from the constant shortage of healthcare workers, human resource management plays a significant business function. Through its activities, human resource management should attract, select, and subsequently retain qualified healthcare workers. Employer branding stands out as a key element for effective talent recruitment and retention, and turnover reduction, contributing to the improvement of the quality of patient care, and enhancing the overall reputation of healthcare organizations (Aeschbacher & Addor, 2021).

Based on the above, the research subject is the employer brand of healthcare organizations. The research objective is to examine the perception of employees about the importance of employer brand of healthcare organizations in the Republic of Serbia.

## EMPLOYER BRAND IN HEALTHCARE INSTITUTIONS

Employer brand is considered the most valuable tool for attracting and retaining the best candidates, including those in the healthcare sector. Therefore, brand management is an essential activity in many organizations. According to the definition provided by Ambler and Barrow (1996), employer brand represents a set of functional, economic, and psychological benefits provided by employment, which are characteristic of the employing organization (Ambler & Barrow, 1996). This initial definition is still considered a general definition today (Kucherov & Zavyalova, 2012). Employer brand can also be defined as the organization's image as perceived by current employees and how potential employees see the organization they might work for (Tanwar & Prasad, 2016). There is a distinction between the concepts of brand and branding. Branding is the process of building a brand, while a brand represents a part of the process of developing its identity and characteristics. Employer branding is an organization's effort to promote, both internally and externally, a clear view of what makes the organization different and desirable as an employer (Backhaus & Tikoo, 2004). Internal employer branding is focused on employees within the organization, aiming to ensure that employees feel satisfied and connected, contributing to greater loyalty and commitment to the job (Punjaisri & Wilson, 2011). External employer branding is designed to attract candidates and represents the identity and job description, as well as the perspective the organization offers to employees (Nagpal & Nagpal, 2019) through advertising and marketing strategies. Information about healthcare organizations can be found on websites, social media, congresses, seminars, television, and radio advertisements, or through sponsorship cooperation (Wijaya, Mustika, Bulut & Bukhori, 2023).

Considering the expected increase in competition in healthcare soon, most healthcare organizations have begun to realize the importance of a good employer branding strategy to be competitive and attract the best candidates from the labor market. The goal of employer brand is to attract and retain the best possible human talent. Employer brand is a planned, long-term strategy that relates to managing the awareness and attitudes of current and future employees. An organization recognized for a successful employer brand has numerous advantages, including improving its reputation in society, enhancing cohesion among employees, and increasing the number of potential candidates, as the organization is positioned as a desirable place to work (Tanwar & Prasad, 2016).

Contemporary definitions clearly emphasize the importance of activities focused on information about both material and non-material employer benefits, as well as the characteristics that set the organization apart as a competitor compared to others present in the market (Saraswathy & Balakrishnan, 2017). Literature has shown numerous benefits of a strong employer brand, including the ability to attract and retain high-quality employees (Piyachat Chanongkorn & Panisa, 2014), motivating employees to greater commitment and loyalty (Kucherov & Zavyalova, 2012), and increasing employee engagement and productivity (Bellou, Rigopoulou & Kehagias, 2015). However, research indicates that employer brand benefits associated with organizational attractiveness also include competitive compensation, social capital, and career development opportunities (Martin-Alcazar, Romero-Fernandez & Sanchez-Gardey, 2005).

To achieve the comprehensive goal of employer branding to become an attractive and competitive organization, a place where people want to work, human resource managers should take certain measures. Accordingly, developing a positive employer brand is an indicator of why a healthcare institution should be the best choice for job seekers. This includes various aspects such as the culture of the healthcare organization, communication style, performance and development, organizational reputation, and overall work environment. Today, there is increasing competition for healthcare workers with the opening of private sector healthcare institutions, so candidates often look beyond salaries and benefits. They strive for positions that align with their values and can provide an advanced career. For this reason, an effective employer branding strategy should provide comprehensive information about the organization's culture and employee benefits, including employee safety, competitive salaries, flexible work schedules to strike a balance between work and private life, professional development opportunities, and a positive work atmosphere.

For a healthcare organization to build a positive brand, it is necessary to motivate employees to achieve better work performance and fully dedicate themselves to their jobs. Organizations should provide more comprehensive benefits, showing concern for employees and their families. This builds trust between employees and the organization. Many organizations offer flexibility in terms of working hours and employee placement, aiming to increase employee motivation and strike a balance between work and private life (Sivertzen, Nilsen & Olafsen 2013; Kumari, Dutta & Bhagat, 2020). However, in healthcare organizations, providing employees with flexible working hours is not easy. Continuity in providing healthcare services requires teamwork, and to improve employee performance as a team, flexibility based on teamwork is necessary. Radical flexibility will encourage employee freedom by providing flexibility in various aspects of work, such as job sharing, teamwork methods, workplace, and working hours (Wijaya, Mustika, Bulut & Bukhori, 2023).

Based on the research objective, the following hypotheses have been defined:

H1: Demographic characteristics (gender and age) have a statistically significant influence on employees' perception of the employer brand in healthcare organizations.

H2: Life circumstances (community living and children) have a statistically significant influence on employees' perception of the employer brand in healthcare organizations.

## RESEARCH METHODOLOGY

A cross-sectional study was conducted to examine the employer brand of healthcare organizations. The research population consisted of employees in healthcare organizations in the Republic of Serbia. The questionnaire designed for the research purposes was distributed to health centers and general hospitals after obtaining consent to conduct the study. A total of 150 questionnaires were distributed, of which two were not valid. The final sample consisted of 148 respondents. Participants expressed their opinions or the degree of agreement/disagreement on a five-point Likert scale, where a rating of one indicated complete disagreement, and a rating of five indicated complete agreement with the statement. The questionnaire comprised eight statements, which are following the preferred HR practice that supports the strengthening of the employer's brand (Villajos, Tordera, Peiró & Veldhoven). Statistical data analysis was performed using the IBM SPSS Statistics software, Version 21.

The research sample consisted of employees in healthcare organizations in the Republic of Serbia, specifically those working in the position of nurse-technicians. The total sample comprised 148 respondents, with the majority being female, constituting 88.5% of the sample. The largest number of employees in healthcare organizations belonged to the age group up to 40 years, making up 37.8% of respondents. Regarding educational levels, 79.1% of respondents had a medium level of education. In terms of work experience, respondents who had been in the healthcare organization for over 21 years dominated (48.6% of respondents). This suggests that individuals often perceive engagement in the public sector as a secure, permanent job, where they spend their entire working life. Of the total number of respondents, 95.9% were employed indefinitely, while 54.7% had no experience in managerial positions. Among employees in healthcare organizations, 87.8% of respondents lived in communities, and 43.9% had adult children.

## RESEARCH RESULTS

To address the research objective, descriptive statistics (mean and standard deviation) were initially conducted to examine the rankings of values concerning statements used in the research process. The degree of agreement among participants with these statements can help identify the significance of various workplace factors in healthcare organizations that influence employer brand.

**Table 1:** Employer Brand in Healthcare Institutions: Rank of Values

Statements	N	Mean	Std. Deviation
Salaries in this healthcare organization are above average.	148	1,83	,979
The healthcare institution guarantees job security to everyone.	148	2,76	1,141
The employment contract I have provides job security.	148	2,80	1,176
Job stability in this healthcare organization is above the usual level.	148	2,66	1,141
I have the option to work part-time if needed.	148	2,26	1,241
The healthcare organization provides all legally mandated options in case of layoffs.	148	2,34	1,193
This healthcare institution is of utmost importance to me.	148	3,05	1,208
I am delighted to work for this organization.	148	3,18	1,276
Valid N (listwise)	148		

Source: Authors

Descriptive statistical analysis showed low mean values, indicating that employees in healthcare organizations in Serbia do not perceive their organization as having a well-established positive employer brand. The statement with the highest mean value, reflecting the highest agreement among respondents, is "I enjoy working for this organization" (Mean=3.18). This indicates the satisfaction of healthcare workers in Serbia, as satisfied employees are likely to have a positive perception of their organization, contributing to a positive employer brand. The statement with the lowest agreement is "Salaries in this healthcare organization are above average" (Mean=1.83), suggesting that salaries in healthcare organizations in Serbia are not competitive.

To gain further insight into the characteristics of employer brand in healthcare organizations, a comparison of attitudes between women and men was conducted. The Mann-Whitney test was applied as a relevant non-parametric technique. The results show a statistically significant difference between genders regarding the perception of job security, legal options in case of layoffs, and the significance of the healthcare organization to employees. Strategies for work-life balance have become essential for enhancing employer brand, particularly in healthcare, where effective teamwork is crucial.

**Table 2: Differences in Employee Attitudes toward Employer Branding Based on Gender**

Statements	Gender	N	Mean Rank	Mann-Whitney test
Salaries in this healthcare organization are above average.	Famale	131	73,51	Z = -0,843 p=0,399
	Male	17	82,15	
	Total	148		
The healthcare institution guarantees job security to everyone.	Famale	131	77,37	Z = -2,343 p=0,019**
	Male	17	52,38	
	Total	148		
The employment contract I have provides job security.	Famale	131	77,84	Z= -2,717 p= 0,007***
	Male	17	48,79	
	Total	148		
Job stability in this healthcare organization is above the usual level.	Famale	131	75,62	Z = -0,928 p= 0,354
	Male	17	65,85	
	Total	148		
I have the option to work part-time if needed.	Famale	131	76,11	Z = -1,325 p= 0,185
	Male	17	62,12	
	Total	148		
The healthcare organization provides all legally mandated options in case of layoffs.	Famale	131	77,58	Z = -2,515 p=0,012**
	Male	17	50,79	
	Total	148		
This healthcare institution is of utmost importance to me.	Famale	131	77,19	Z=-2,179 p= 0,029**
	Male	17	53,76	
	Total	148		
I am delighted to work for this organization.	Famale	131	76,82	Z = -1,878 p= 0,060*
	Male	17	56,62	
	Total	148		

Notes: p&lt;0,01\*\*\*; p&lt;0,05\*\*; p&lt;0,1\*

Source: Authors

The results of non-parametric test related to employer brand statements show a statistically significant difference in the perception of job stability, the opportunity for part-time work, and legal options in case of layoffs based on the living arrangements of respondents.

**Table 3: Differences in Employee Attitudes toward Employer Branding Based on Life Circumstances**

Statements	Life circumstances	N	Mean Rank	Mann-Whitney test
Salaries in this healthcare organization are above average.	They live alone	18	76,39	Z= -0,215 p= 0,830
	They live in a community	130	74,24	
	Total	148		
The healthcare institution guarantees job security to everyone.	They live alone	18	62,11	Z= -1,355 p=0,175
	They live in a community	130	76,22	
	Total	148		
The employment contract I have provides job security.	They live alone	18	63,08	Z= -1,246 p= 0,213
	They live in a community	130	76,08	
	Total	148		
Job stability in this healthcare organization is above the usual level.	They live alone	18	55,31	Z= -2,127 p= 0,033**
	They live in a community	130	77,16	
	Total	148		
I have the option to work part-time if needed.	They live alone	18	54,17	Z= -2,248 p= 0,025**
	They live in a community	130	77,32	
	Total	148		
The healthcare organization provides all legally mandated options in case of layoffs.	They live alone	18	56,81	Z= -1,939 p= 0,053*
	They live in a community	130	76,95	
	Total	148		
This healthcare institution is of utmost importance to me.	They live alone	18	62,03	Z= -1,354 p= 0,176
	They live in a community	130	76,23	
	Total	148		

I am delighted to work for this organization.	They live alone	18	61,83	Z= -1,374 p= 0,170
	They live in a community	130	76,25	
	Total	148		

Notes: p<0,01\*\*\*; p<0,05\*\*; p<0,1\*

Source: Authors

Further research applied the Kruskal-Wallis's analysis as a relevant non-parametric technique. Three categories of sub-samples were extracted, relating to respondents without children and those with children, depending on their age. The results show a statistically significant difference in statements such as "The healthcare institution guarantees job security to everyone" and "This healthcare institution means a lot to me."

**Table 4:** Differences in Employee Attitudes toward Employer Branding Based on Life Circumstances (Children)

Statements	Children	N	Mean Rank	Kruskal Wallis test
Salaries in this healthcare organization are above average.	I do not have children	21	72,93	X <sup>2</sup> =5,589 df=2 p=0,061*
	I have children of school age	62	66,25	
	I have grown children	65	82,88	
	Total	148		
The healthcare institution guarantees job security to everyone.	I do not have children	21	67,12	X <sup>2</sup> =9,573 df=2 p=0,008***
	I have children of school age	62	64,57	
	I have grown children	65	86,35	
	Total	148		
The employment contract I have provides job security.	I do not have children	21	69,69	X <sup>2</sup> =4,029 df=2 p=0,133
	I have children of school age	62	68,05	
	I have grown children	65	82,21	
	Total	148		
Job stability in this healthcare organization is above the usual level.	I do not have children	21	62,69	X <sup>2</sup> =2,131 df=2 p=0,345
	I have children of school age	62	75,36	
	I have grown children	65	77,49	
	Total	148		
I have the option to work part-time if needed.	I do not have children	21	65,07	X <sup>2</sup> =1,948 df=2 p=0,378
	I have children of school age	62	73,06	
	I have grown children	65	78,92	
	Total	148		
The healthcare organization provides all legally mandated options in case of layoffs.	I do not have children	21	75,00	X <sup>2</sup> =0,009 df=2 p=0,995
	I have children of school age	62	74,14	
	I have grown children	65	74,68	
	Total	148		
This healthcare institution is of utmost importance to me.	I do not have children	21	71,00	X <sup>2</sup> =9,496 df=2 p=0,009***
	I have children of school age	62	63,51	
	I have grown children	65	86,12	
	Total	148		
I am delighted to work for this organization.	I do not have children	21	71,83	X <sup>2</sup> =2,358 df=2 p=0,308
	I have children of school age	62	69,24	
	I have grown children	65	80,38	
	Total	148		

Notes: p<0,01\*\*\*; p<0,05\*\*; p<0,1\*

Source: Authors

To investigate employee attitudes toward employer brand based on age, the Kruskal-Wallis's analysis was also applied. A statistically significant difference was found in statements related to above-average salaries, job security guarantees, and the significance of the organization to employees.

**Table 5:** Differences in Employee Attitudes toward Employer Branding Based on Age

Statements	Age	N	Mean Rank	Kruskal Wallis test
Salaries in this healthcare organization are above average.	less than 40 years	56	65,41	$\chi^2 = 7,337$ df=2 $p=0,026^{**}$
	from 41 to 50 years	47	73,46	
	more than 51 years	45	86,90	
	Total	148		
The healthcare institution guarantees job security to everyone.	less than 40 years	56	58,57	$\chi^2 = 13,368$ df=2 $p=0,001^{***}$
	from 41 to 50 years	47	83,66	
	more than 51 years	45	84,76	
	Total	148		
The employment contract I have provides job security.	less than 40 years	56	64,86	$\chi^2 = 5,387$ df=2 $p=0,068^*$
	from 41 to 50 years	47	77,33	
	more than 51 years	45	83,54	
	Total	148		
Job stability in this healthcare organization is above the usual level.	less than 40 years	56	68,58	$\chi^2 = 2,326$ df=2 $p=0,313$
	from 41 to 50 years	47	80,85	
	more than 51 years	45	75,23	
	Total	148		
I have the option to work part-time if needed.	less than 40 years	56	66,66	$\chi^2 = 3,708$ df=2 $p=0,157$
	from 41 to 50 years	47	76,61	
	more than 51 years	45	82,06	
	Total	148		
The healthcare organization provides all legally mandated options in case of layoffs.	less than 40 years	56	70,44	$\chi^2 = 0,881$ df=2 $p=0,664$
	from 41 to 50 years	47	77,40	
	more than 51 years	45	76,52	
	Total	148		
This healthcare institution is of utmost importance to me.	less than 40 years	56	64,36	$\chi^2 = 7,040$ df=2 $p=0,030^{**}$
	from 41 to 50 years	47	75,11	
	more than 51 years	45	86,49	
	Total	148		
I am delighted to work for this organization.	less than 40 years	56	69,70	$\chi^2 = 1,936$ df=2 $p=0,380$
	from 41 to 50 years	47	73,76	
	more than 51 years	45	81,26	
	Total	148		

Notes:  $p < 0,01^{***}$ ;  $p < 0,05^{**}$ ;  $p < 0,1^*$ 

Source: Authors

## DISCUSSION

Based on the results, the preliminary conclusion is that employees in healthcare organizations in Serbia do not perceive a well-developed positive employer brand. Detailed analysis of each statement is necessary. In the study, two hypotheses were formulated. The first hypothesis was set to determine whether demographic characteristics (gender and age) have a statistically significant influence on employees' perceptions of the employer brand of healthcare organizations in the Republic of Serbia. Based on the obtained results, hypothesis H1 is partially confirmed. A statistically significant difference exists among genders regarding employees' perception that the healthcare organization and the employment contract guarantee security, that the organization provides the opportunity for shortened working hours, offers all legally prescribed options in case of dismissal, and that the healthcare organization means a lot to them. When considering the results based on age, it is concluded that employees older than 50 see healthcare institutions in the public sector in Serbia as a secure place to work, consider their salaries to be above average, and believe that the healthcare organization guarantees job security. Research conducted by Aeschbacher & Addor (2021) shows that there is an increasing likelihood that healthcare workers at the beginning of their careers will leave public sector healthcare organizations due to a lack of advancement opportunities, dissatisfaction with salaries, and/or due to too many tasks that are not part of the job description.

The second hypothesis was defined to determine whether life circumstances (living in a community and having children) have a statistically significant impact on employees' perceptions of the employer brand of healthcare organizations in the Republic of Serbia. The results of the conducted statistical analysis show that hypothesis H2 is partially confirmed. Healthcare workers who live in communities and have children see healthcare institutions in the

public sector in Serbia as a secure place to work, with above-average salaries, and the institution means a lot to them. Building a positive employer brand is a powerful tool for attracting and retaining top talents. Creating a positive work environment that contributes to employer branding can build unity among employees, leading to improved teamwork and collaboration and retaining talents in the organization.

In the public healthcare sector, financial rewards are the same, and employees believe that salaries are not above average. To differentiate one healthcare organization from another and be an attractive workplace, organizations need to provide career development opportunities, employee prestige, benefits, and focus on developing organizational culture through employer branding. Kucherov and colleagues (2022) found that the development of a strong employer brand influences improvements in hiring outcomes, attracts top talents, reduces turnover rates, and leads to higher job satisfaction and loyalty among employees. They also argue that every organization should work on strengthening the employer brand of healthcare organizations because, in addition to making the organization an attractive place for talent, it also contributes to building the corporate brand.

Due to the scientific research gap and the limited number of scientific papers in domestic academic conditions dealing with employer branding in healthcare organizations, this research has practical implications:

- An established employer brand contributes to employees perceiving the organization as providing security and being a desirable place to work.
- The way human resources management activities are conducted affects the development of a positive employer brand and the formation of an image of the healthcare organization among employees and potential employees. Therefore, it is extremely important to develop a positive, unique, and recognizable employer brand in healthcare organizations.

In addition to its contributions, the conducted research also has certain limitations, necessitating guidelines for future research. In fact, the study included a relatively small number of respondents who are employed in secondary-level healthcare organizations in Central Serbia. Therefore, future research should expand by increasing the number of respondents and include other types of healthcare institutions, such as primary health care centers, hospitals, and university clinical centers, thereby creating space for comparing the attitudes of employees in these institutions.

## CONCLUSION

For healthcare organizations to provide adequate healthcare services, they need to attract and retain highly qualified workers. Managers define various approaches to motivate employees to provide quality healthcare services. Employees who are more satisfied and perceive job security have a greater potential to stay in the organization and are motivated for better performance. This can lead to increased dedication and loyalty of healthcare workers, contributing to higher satisfaction among patients. Based on the research, it is essential for HR managers in healthcare organizations in Serbia to focus their activities on strengthening employer branding. Results indicate that older employees, living in communities and having children, perceive healthcare organizations as a secure place to work. HR managers should build an innovative-oriented organizational culture, improve communication, and team management to attract younger populations and retain quality employees.

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**Marko Slavković**  
 University of Kragujevac Faculty of  
 Economics,  
 Kragujevac, Serbia

msslavkovic@kg.ac.rs

**Marijana Bugarčić**  
 University of Kragujevac Faculty of  
 Economics,  
 Kragujevac, Serbia

marijana.bugarcic@ef.kg.ac.rs

**Vesna Stojanović Aleksić**  
 University of Kragujevac Faculty of  
 Economics,  
 Kragujevac, Serbia

vesnasa@kg.ac.rs

**Marija Mirić**  
 University of Kragujevac Faculty of  
 Economics,  
 Kragujevac, Serbia

marija.miric@ef.kg.ac.rs

**Dejana Zlatanović**  
 University of Kragujevac Faculty of  
 Economics,  
 Kragujevac, Serbia

dejanaz@kg.ac.rs

## FACTORS THAT DRIVE BRAIN DRAIN IN GENERATION Z: A LESSON LEARNED

**Abstract:** Negative migration, including individuals with higher education and in the early stages of their professions, has been ongoing for many decades. It is essential to keep talented young people in the nation by creating an environment that enables them to reach their full potential and respond to their requirements. This research intends to examine the factors that drive Generation Z individuals to emigrate from their home country. The authors conducted a systematic literature review by accessing several databases such as Google Scholar, Web of Science, and Scopus.

**Keywords:** Generation Z, Brain Drain, Talent Management

### 1. INTRODUCTION

Traditionally, the primary drivers of economic progress were financial capital, land, machines, etc (Zhatkanbaeva, Zhatkanbaeva & Zhatkanbaev, 2012). However, the potential for their substitution and the depreciation over time have shifted the focus towards intellectual resources, with knowledge emerging as paramount. Knowledge can be regarded as a form of capital, albeit one that is not easily replicated or replaced. Human capital encompasses specific knowledge and skills acquired through various educational programs and work experiences (Wächter, 2006). While human capital is often associated with talent within a society or organization (Bhore & Tapas, 2023), it is crucial to recognize that talents and human capital can be cultivated through specific human resource management strategies. In addition to employee development programs and targeted training initiatives, the nurturing of talents and human capital demands meticulous workforce planning, regular performance assessments, the design of a reward system encompassing intrinsic and extrinsic benefits, and succession planning (Hejase, Hejase, Mikdashi & Bazeih, 2016; Hongal & Kinange, 2020). Due to its scarcity, there is a growing demand for human capital, leading to the emergence of the "War for Talents" concept. Organizations seek to attract talent from external markets, often from other countries. When human capital migrates from its country of origin, it results in a phenomenon known as *brain drain*, representing a loss for the home country, which has invested significant resources in its formation. Conversely, the destination country experiences *brain gain*, acquiring valuable knowledge without prior investment (Wächter, 2006). Brain drain refers to the departure of valuable human capital and talented individuals from a country, a phenomenon often driven by various socio-economic, political, and/or other factors. Brain drain predominantly involves the emigration of highly educated, experienced, and often young individuals, leading to demographic challenges within the country (Iqbal, Wang, Khurshaid, Shah & Sohaib, 2021; Parker et al., 2022).

Today, particular attention must be paid to the brain drain affecting the youngest generation worldwide, particularly Generation Z, the youngest segment of the workforce. As noted by Barhate & Dirani (2021), a generation represents a

group of individuals born within a specific time frame or cultural-historical context, often sharing common characteristics and attitudes. This can undoubtedly be said about Generation Z, who grew up in a period of difficult economic conditions, confronted the onset of a COVID-19 pandemic early in their careers, and possess adeptness with modern technological solutions (Ahmed, Ahmed, Ahmed & Khan, 2022; Alvarez-Macias, Villafranca & Villafranca, 2023). Today, organizations worldwide seek creative and youthful talent to foster a diverse workforce structure, contributing to overall success with their distinct human capital (Bhore & Tapas, 2023). Multinational corporations' specialized talent management programs attract talented members of Generation Z, further exacerbating the brain drain of this generation due to a confluence of socio-economic, political, and other factors. Given the above, the aim of this paper is to investigate the factors contributing to the brain drain of Generation Z, with the goal of deriving conclusions and recommendations based on the findings to delineate approaches for retaining this generation's talents within their home countries.

The systematic literature review method was used for conceptualization and content development. A systematic literature review (SLR) is a rigorous academic approach that seeks to discover and assess all pertinent literature on a particular subject in order to draw definitive findings regarding the specific inquiry at issue (Tranfield, Denyer & Smart, 2003). The initial stage of the methodology's implementation involved conducting a Google Scholar database search for relevant articles containing the following keywords: generation Z, brain drain, and talent management. By adopting this approach, a more extensive collection of articles was amassed, and their pertinence was assessed via their inclusion in the Web of Science and Scopus databases. Upon the conclusion of the process, the articles utilized for the literature review were chosen. Additionally, other relevant publications whose content is of essential importance for the topic are included in the literature review.

## 2. LITERATURE REVIEW

It is important to note that there is still no consensus regarding the birth years that define Generation Z. Views vary, with some considering this generation to be born in the mid-nineties, while others suggest it encompasses individuals born between 1995 and 2001, or after 1996, or even after 1997. Accordingly, Generation Z is often referred to as the Multitasking Generation, Digital Generation, Digital Natives, Media Generation, iGeneration, etc (Bieleń & Kubiczek, 2020). For the purposes of this paper, Generation Z is defined as individuals born after 2000, characterized by their speed and reliance on technology. While sharing certain similarities with the preceding Generation Y, Generation Z exhibits distinct values and attitudes, being more socially inclusive and typically born into smaller families. Moreover, during their formative years, members of Generation Z faced various challenges such as economic recession and the COVID-19 pandemic (Dikeç, Öztürk, Taşbaşı, Figenergül & Güler, 2023). Unlike their predecessors, Generation Z grew up immersed in technology and the Internet, integrating global networking and digital literacy into their daily lives and work routines. Mobility, proficiency in foreign languages, communication skills, cultural openness, and digital literacy are key traits that define a significant portion of Generation Z as talented individuals (Bieleń & Kubiczek, 2020; Csobanka, 2016). As the latest cohort to enter the labor market, Generation Z is characterized by their ability to learn quickly, adapt readily to new technologies, and their willingness to pursue international career opportunities (Bhore & Tapas, 2023), rendering them a sought-after workforce by organizations worldwide. Presently, Generation Z comprises over 2 billion individuals, accounting for approximately 30% of the global population (Chomařovska, Janiak-Rejno, Strugała & Źarcynksa-Dobeisz, 2022). Within this demographic lies a talented workforce, characterized by high mobility and adaptability.

The distinctiveness of Generation Z is apparent in their early career stages, where pivotal decisions are made that can significantly impact their life trajectories. Similar to other adolescents and young adults, members of Generation Z carefully consider career options, often opting for opportunities abroad for further professional development and utilization of their human capital (Ahmed et al., 2022). This decision, in turn, facilitates multinational companies' access to valuable talents located overseas, marking one of the initial factors triggering the brain drain of Generation Z. Career pursuits are intrinsically linked to the formal development of human capital, thereby necessitating a consideration of education system-related factors in the countries from which human capital migrates. Particularly in less developed economies, brain drain among Generation Z is further exacerbated by high unemployment rates, challenges in securing employment, and a dearth of practical skills perceived as relevant by this generation (Fakhrutdinova, Kolesnikova, Suleimanov & Khalikov, 2014).

It's common for young individuals to find employment in the regions where they pursued their education. This phenomenon not only fuels internal migration but also prompts international migration, especially if formal education was obtained abroad. The root of the issue often lies in shortcomings within the education system, which can prompt young people to seek opportunities overseas and eventually settle abroad. These issues include a mismatch between educational offerings and market demands, insufficient practical guidance throughout all educational stages, and a lack of personalized educational programs (Hornstein Tomić & Taylor, 2018). These challenges are particularly pertinent for Generation Z, who may find certain educational paths and occupational roles outdated, compelling them to seek education and employment abroad. Baláz, Williams & Kollár (2004) assert that alongside low wages and limited employment prospects, inadequacies within the education system have historically driven migration. Education plays a pivotal role in career development by imparting both theoretical and practical knowledge relevant to future

employment. More developed economies often boast superior educational systems that, in conjunction with robust economies, offer curricula tailored to the practical needs of young individuals, facilitating quality employment opportunities and higher wages (Sano, Hillier, Haan & Zarifa, 2020). Acquisition of technical knowledge, career preparation, and subsequent career progression, coupled with opportunities for lucrative employment, are intertwined factors influencing the brain drain among Generation Z (Bhore & Tapas, 2023). The allure of diverse career opportunities motivates Generation Z to seek varied knowledge and skills, often within organizations outside their home countries. Consequently, human resource managers are devising talent development strategies that encompass tailored career advancement programs, with an emphasis on cross-cultural training and managing workforce diversity, including members of Generation Z from diverse cultural backgrounds (Barhate & Dirani, 2021; Ngoc, Dung, Rowley & Bach, 2022). A significant proportion of Generation Z is willing to relocate permanently for educational and career advancement purposes (Chomařovska et al., 2022). To attract this talented workforce, talent managers are implementing programs that address the preferences of Generation Z in the workplace, such as work-life balance, flexible schedules, job security, inclusive organizational cultures, training opportunities, career advancement prospects, and competitive salaries (Barhate & Dirani, 2021). In regions where free movement between countries is facilitated, such as within the European Union, talent migration is streamlined, further exacerbating the brain drain of Generation Z (Baláz et al., 2004).

The issue of employment among members of Generation Z instills concern about their personal futures, constituting another factor driving the brain drain within this generation (Dikeç et al., 2023). Unemployment engenders a decline in quality of life, poverty, and potential social exclusion, particularly among individuals hailing from rural areas (Icoski, 2022). In addition to factors related to employment, certain socio-political factors from the external environment, which initiate brain drain, must also be acknowledged. Sano et al. (2020) highlight the significance of environmental quality and a clean, healthy environment as factors influencing migration decisions. Members of Generation Z exhibit a heightened awareness of environmental issues and the importance of sustainable development, recognizing the pivotal role of a clean environment in enhancing quality of life. Social stability, closely intertwined with political stability, is another critical consideration. Wars, social unrest, and terrorist attacks are among the factors that catalyze the brain drain of Generation Z (Barhate & Dirani, 2021). Such upheavals typically precipitate major social crises, serving as drivers of brain drain across the population, particularly affecting young people (Benitez-Márquez, Sánchez-Teba, Bermúdez-González & Núñez-Ridman, 2022). For instance, a study by UNHCR conducted on March 14, 2024, revealed that since the onset of the conflict between Ukraine and Russia, 5,982,900 refugees from Ukraine have sought refuge in Europe (UNHCR, April 2024, Ukraine refugee situation, retrieved April 7, from <https://data.unhcr.org/en/situations/ukraine>). Consequently, in regions marked by violence, crime, social unrest, and political instability, human capital tends to migrate to environments offering better social conditions (Iqbal et al., 2021). Moreover, intrinsic risk factors contributing to the brain drain of Generation Z can be identified. Primarily, the attitudes of Generation Z members, both towards themselves and foreign countries, play a significant role (Assfaw & Minaye, 2022). A strong positive self-perception, the desire for personal development and a better life, coupled with favorable attitudes towards foreign nations, increase the likelihood of brain drain. Technological advancements have facilitated direct and continuous interaction with individuals from diverse cultures, enhancing cultural adaptability (Barhate & Dirani, 2021). Generation Z predominantly engages with computers and smartphones, spending significant time on various social networks (Csobanka, 2016). Alvarez-Macias et al. (2023) assert that social networks and the Internet serve as catalysts for the brain drain of Generation Z. Continuous exposure to foreign cultural content often diminishes national identity among Generation Z members, fostering cultural homogeneity and a heightened preference for living and working in foreign cultures portrayed as "ideal" on social media platforms. Some Generation Z individuals may perceive their own culture as restrictive due to societal norms dictating predefined behaviors, as noted by these authors. Iqbal et al. (2021) categorize these factors into 1) individual factors (e.g., personal attitudes, self-perception, motivation), 2) motivational factors (e.g., opportunities for a better life, cultural appeal of foreign countries), 3) institutional factors (e.g., rule of law, democracy, environmental quality), and 4) labor market factors (e.g., employment opportunities, training, higher wages). Lastly, it's important to acknowledge that bilateral agreements between countries can incentivize brain drain among Generation Z's human capital, particularly through provisions allowing for the free movement of labor and simplified procedures for obtaining work permits in foreign countries (Icoski, 2022).

## **2. GLOBAL CONTEXT OF GENERATION Z BRAIN DRAIN**

Analyzing explicit indicators regarding the brain drain of Generation Z and the migration of talented labor can pose challenges. Statistics in this realm are highly diverse, and there lacks a unified data source, leading to discrepancies in information provided by various organizations (Wächter, 2006; Baláz et al, 2004). Consequently, deductive reasoning from general observations is necessary, examining the scope of Generation Z's brain drain and the diverse factors influencing it across different contexts through the method of generalization.

Talent migration is a prevalent global phenomenon. On average, 4% of talented individuals depart from highly developed economies to other countries. In medium-developed economies, this figure rises to 10%, and in less developed economies, it surges to 20%. Notably, young individuals with college education predominantly emigrate from less developed and underdeveloped economies. For instance, in Cambodia, 25.6% of individuals under the age of

25 with a university degree have left the country. Moreover, in Sub-Saharan Africa, the Caribbean, and the Pacific, the brain drain among young university graduates is up to 30 times higher than the rate of emigration among those with lower levels of education. Alarming, over 70% of highly educated individuals from Cabo Verde have relocated abroad for work. By the end of 2018, more than 25,000 doctors who completed medical studies in Sub-Saharan Africa had migrated to one of the developed OECD countries (World Bank, 2023). In recent years, the highest number of educated young professionals have emigrated from small island developing states. According to fDiIntelligence, Samoa tops the list, with a brain drain index (also known as Human Capital Flight Index) of 10 out of 10 (fDiIntelligence, 2023 April, Brain drain: countries with the greatest human capital flight, retrieved April 7, from <https://www.fdiintelligence.com/content/data-trends/brain-drain-countries-with-the-greatest-human-capital-flight-82395>). The International Organization for Migration provides pertinent data for understanding the global brain drain situation of Generation Z. According to their estimates, the international migrant population reached 281 million by the end of 2020, reflecting an average growth rate of 3.6% compared to the 1990 period. Among the total migrant population, 73% are of working age, with the largest segment comprising individuals aged 20-39 (approximately 100 million). Within the population under 20, which includes Generation Z, the proportion of migrants is 15% (International Organization for Migration, 2021 February, International migrant stocks, retrieved April 8, from <https://www.migrationdataportal.org/themes/international-migrant-stocks>). Further analysis by the International Organization for Migration reveals that young individuals aged 15-24, representing Generation Z, account for 11% of the total migrant population. Notably, the largest migration flows within this age group originate from Africa (16%), followed by Latin America and the Caribbean (15%), Oceania (15%), Asia (12%), North America (10%), and Europe (9%) (International Organization for Migration, 2024 February, Child and young migrants, retrieved April 8, from <https://www.migrationdataportal.org/themes/child-and-young-migrants>). Moreover, it is estimated that, on average, 10% of these migrations represent the brain drain of Generation Z's human capital, with a higher proportion of male migrants (58.5%) compared to female migrants (41.5%) (International Organization for Migration, 2022 February, Labor migration, retrieved April 7, from <https://www.migrationdataportal.org/themes/labour-migrations>).

According to Zhatkanbaeva et al. (2012), a consistent trend observed in Kazakhstan is the departure of young individuals from the country if they fail to secure employment after completing their studies, amounting to an average of 10% of all graduates. Similarly, Croatia faces challenges in this regard, particularly accentuated during its accession to the European Union, which opened borders for international labor migration. The period following EU integration witnessed a significant surge in the emigration of young graduates, including Generation Z, with the brain drain of competent professionals quadrupling within just two years of joining the EU. Official statistics from Croatia indicate that brain drain is most pronounced among individuals aged 20-24 and 25-29, with higher figures observed among men (Hornstein Tomić & Taylor, 2018). Research conducted in Turkey among students born after 2000 (with an average age of 22.45) identified four major groups of brain drain factors among Generation Z. Economic factors take precedence, including the inability to secure employment, low income, and challenges in meeting basic needs, often regarded as luxuries. Social factors, such as ongoing social unrest and instability, constitute the second group of factors. A deficient education system failing to impart necessary knowledge and shortcomings in the judiciary system comprise the third group, while the fourth group revolves around political issues and media manipulation (Dikeç et al., 2023).

Countries in the Western Balkans increasingly grapple with the brain drain of Generation Z, accompanied by adverse demographic shifts. Apart from political factors, key reasons for youth departure include limited employment prospects, inadequate training opportunities, and social discrimination. Bilateral arrangements between certain Western Balkan countries, like Bosnia and Herzegovina and Germany, exacerbate brain drain levels. Studies reveal that a significant percentage of young individuals from Montenegro (26%), Bosnia and Herzegovina (27%), Serbia (30%), North Macedonia (35%), and Albania (43%) plan to leave their countries (Icoski, 2022). For instance, a study conducted among students in North Macedonia aged 21-26 identified three sets of factors driving brain drain: employment challenges and lack of professional development opportunities, institutional issues including political instability, healthcare and education deficiencies, corruption, and environmental pollution, and cultural constraints such as rigid social norms and predefined behavioral rules (Parker et al., 2022). In Poland, research among students aged 21-25 pinpointed training opportunities abroad as a primary reason for Generation Z's departure, followed by the inability to secure meaningful employment and a desire to explore job prospects overseas (Chomałowska et al., 2022).

When it comes to the developed economies of the world, such as Canada, the research shows that the largest percentage of the population that plans to leave the country are members of Generation Z, aged 15-24. However, it is primarily about residents of rural areas, who first plan to migrate to urban areas within Canada (Sano et al., 2020). Contrasting findings emerged from a study encompassing Canadians, US residents, and Mexicans aged 15-20, revealing divergent migration intentions among participants (Alvarez-Macias et al., 2023):

- Members of Generation Z in Canada have positive attitudes towards leaving the country if there are better conditions abroad. However, such attitudes do not necessarily imply behavior, as Canadians do not aim to leave the country.
- Members of Generation Z in Mexico see leaving the country as a desirable option and would be happy to do so.
- Members of Generation Z in the US have completely different attitudes, i.e. migrating from the country is not their goal at all, nor is it in the plan.

Based on these findings, it is preliminarily assumed that the brain drain of Generation Z globally is primarily influenced by the level of economic and social development. However, it's essential to consider the international movement of Generation Z within the context of their career aspirations. The presence of organizations abroad that can fulfill their career needs can contribute to brain drain. In a study involving young people aged 17-20 (with an average age of 18.94), it was demonstrated that internal factors play a crucial role in career considerations. These include job satisfaction, self-validation, and opportunities for skill enhancement and learning on the job. External factors such as salary level, employment in one's chosen profession, opportunities for career advancement, and additional benefits also significantly influence career choices (Ahmed et al., 2022). The attractiveness of these factors is particularly evident in underdeveloped environments where organizations struggle to offer such opportunities. For instance, professionals from Ethiopia are increasingly seeking opportunities in Western Europe, North America, and Australia (Assfaw & Minaye, 2022). Arar & Öneren (2018) identify additional career factors that may prompt Generation Z to leave their home country, including work-life balance, engaging and innovative tasks, utilization of technology in the workplace, working in a conducive office environment, and a dynamic workplace culture. Ngoc et al. (2022) emphasize factors like work-life balance, communication through modern digital technology, opportunities for innovation, chances to demonstrate leadership skills, autonomy, and social networking opportunities at work. This information is particularly valuable for talent management, as HR managers can tailor work environments to attract and retain Generation Z talent and human capital.

### **3. PRACTICAL IMPLICATIONS**

The research conducted on the brain drain phenomenon among Generation Z offers several practical implications for policymakers, organizations, and HR managers worldwide. Understanding the underlying factors driving the emigration of young talent can inform strategies aimed at retaining skilled individuals within their home countries and ensuring sustainable economic development.

Firstly, acknowledging the significant role of economic and social development in determining the brain drain of Generation Z is crucial for policymakers. Governments of both developed and developing nations must prioritize initiatives that foster economic growth, create job opportunities, and improve social conditions. Investing in education, vocational training programs, and infrastructural development can equip young individuals with the skills and resources needed to thrive in their home countries, thereby reducing the incentive to seek opportunities abroad. Additionally, bilateral agreements between countries, such as those facilitating labor migration, should be carefully evaluated to minimize negative impacts on sending countries. While these agreements can benefit individuals seeking better opportunities abroad, they may exacerbate brain drain in countries experiencing skill shortages. Policymakers should negotiate agreements that promote mutual benefit and consider implementing measures to retain skilled professionals, such as offering incentives for returning migrants or encouraging knowledge transfer. Collaboration between governments, educational institutions, and private sector stakeholders is key to implementing effective solutions. By fostering partnerships and sharing best practices, stakeholders can leverage collective expertise and resources to address the problem of the brain drain phenomenon. Furthermore, addressing the specific challenges faced by Generation Z in different regions is essential for mitigating brain drain. For example, in underdeveloped economies, efforts should focus on improving the quality of education, providing practical training opportunities, and creating a conducive environment for entrepreneurship. Similarly, in developed economies, attention should be given to addressing issues related to work-life balance, career development, and social integration for migrant youth.

Moreover, recognizing the importance of career aspirations in shaping migration decisions highlights the need for organizations to adapt their recruitment and retention strategies. HR managers should focus on creating attractive work environments that align with the preferences of Generation Z. This includes offering competitive salaries, opportunities for career advancement, work-life balance initiatives, and innovative work tasks. By understanding the internal and external factors influencing career choices, organizations can enhance their appeal to young talent and mitigate the risk of brain drain.

The research on brain drain among Generation Z yields valuable insights for designing and implementing effective talent management programs within organizations. Recognizing the factors influencing the migration decisions of young professionals can inform HR managers about the strategies needed to attract, develop, and retain top talent. Firstly, talent management programs should be tailored to meet the specific needs and preferences of Generation Z. This demographic cohort values job satisfaction, opportunities for skill enhancement, and a conducive work environment. Therefore, HR managers should prioritize initiatives that promote employee engagement, provide ongoing learning and development opportunities, and foster a supportive workplace culture. By aligning talent management practices with the preferences of Generation Z, organizations can enhance employee satisfaction and retention rates. Furthermore, organizations should prioritize diversity and inclusion initiatives to attract and retain a diverse workforce, including members of Generation Z. Diversity not only fosters creativity and innovation but also reflects the globalized nature of modern workplaces. HR managers should implement inclusive recruitment practices, provide cultural sensitivity training, and create opportunities for cross-cultural collaboration. By embracing diversity, organizations can attract talented individuals from diverse backgrounds and foster a culture of belonging. Moreover, talent management programs should incorporate flexible work arrangements to accommodate the preferences of Generation Z, who

prioritize work-life balance and flexibility. Offering options such as remote work, flexible hours, and alternative work arrangements can enhance employee satisfaction and productivity. HR managers should also leverage technology to facilitate remote collaboration and communication, enabling employees to work efficiently from anywhere. Additionally, organizations should invest in leadership development programs to groom the next generation of leaders from within. Generation Z values opportunities for career advancement and leadership development, making succession planning a critical aspect of talent management. HR managers should identify high-potential employees early on, provide them with mentoring and coaching opportunities, and create clear pathways for career progression. By investing in leadership development, organizations can cultivate a pipeline of future leaders who are equipped to drive innovation and growth. Furthermore, talent management programs should prioritize employee well-being and mental health support. Generation Z places a high value on holistic well-being, including physical, mental, and emotional health. HR managers should implement wellness programs, provide access to counseling services, and promote a culture of openness and support. By prioritizing employee well-being, organizations can foster a positive work environment and improve employee retention rates.

## 4. CONCLUSIONS

The research on brain drain among Generation Z sheds light on the complex correlation of factors driving the emigration of young talent from their home countries. Historically, economic progress has been primarily fueled by material resources such as capital and land. However, with the advent of globalization and technological advancements, the significance of intellectual resources, particularly knowledge, has surged. Human capital, comprising specific knowledge and skills acquired through education and work experience, has emerged as a cornerstone of economic development. Talent management, therefore, plays a pivotal role in harnessing and retaining the intellectual capital vital for organizational success in today's knowledge-based economy. Generation Z, born in the digital age and characterized by their technological fluency and cultural openness, represents a valuable pool of talent sought after by organizations worldwide. However, the phenomenon of brain drain poses a significant challenge, as talented individuals often migrate to countries offering better career opportunities, higher wages, and improved quality of life. The "War for talents" intensifies as organizations compete to attract and retain skilled individuals, leading to a global talent mobility landscape.

The decision of Generation Z members to migrate is influenced by a myriad of factors, including economic, social, political, and cultural considerations. Economic factors, such as unemployment, low wages, and limited career prospects, often drive young professionals to seek opportunities abroad. Social instability, political unrest, and lack of social cohesion further exacerbate the brain drain phenomenon, particularly in regions plagued by conflict and instability. Moreover, cultural factors, such as a desire for personal and professional growth, exposure to diverse cultures, and a sense of belonging, also shape migration decisions among Generation Z. Education systems play a crucial role in preparing young individuals for the workforce and determining their migration patterns. Discrepancies between educational curricula and market demands, coupled with limited opportunities for practical training and career guidance, contribute to the brain drain problem, particularly in less developed economies. Additionally, bilateral agreements between countries facilitating labor migration can exacerbate brain drain, as talented individuals are lured by the promise of better prospects abroad. Organizations can implement effective talent management strategies to attract and retain Generation Z talent, which can also cause brain draining, if those organizations are coming from abroad. Tailoring recruitment and retention initiatives to align with the preferences and values of Generation Z, including offering competitive salaries, opportunities for career advancement, and flexible work arrangements, can enhance organizational appeal. Moreover, fostering diversity and inclusion, prioritizing employee well-being and mental health support, and investing in leadership development programs are essential components of effective talent management practices.

The phenomenon of brain drain among Generation Z underscores the importance of proactive measures to retain and nurture intellectual capital within organizations and countries. By addressing the root causes of brain drain and implementing strategic talent management initiatives, organizations and policymakers can foster an environment conducive to retaining and harnessing the potential of Generation Z talent for sustained economic growth and development.

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**Bojan Leković**  
 University in Novi Sad  
 Faculty of Economics in Subotica  
 Subotica, Republic of Serbia  
 e-mail: bojan.lekovic@ef.uns.ac.rs

**Dušan Bobera**  
 University in Novi Sad  
 Faculty of Economics in Subotica  
 Subotica, Republic of Serbia  
 e-mail: dusan.bobera@ef.uns.ac.rs

**Milenko Matić**  
 University in Novi Sad  
 Faculty of Economics in Subotica  
 Subotica, Republic of Serbia  
 e-mail: milenko.matic@ef.uns.ac.rs

## PROCESS INNOVATION AS A RESULT OF CRM MECHANISMS

**Abstract:** This paper aims to examine the impact of different cooperation mechanisms with customers on the development of process innovation in companies in AP Vojvodina in the Republic of Serbia. Customer collaboration mechanisms include information sharing with customers, joint problem solving with customers, and technology used in customer relationships. In the software package for statistical data analysis Smart PLS 4, a statistical analysis of the data obtained by conducting a questionnaire in companies in AP Vojvodina was performed. The sample includes 31 companies, and its owners or general managers were responsible for filling it out. The results showed that joint problem solving with customers and the application of technology in relations with them significantly and positively affects the development of process innovations. In addition, information sharing with customers also has a positive impact on process innovation, but it is not statistically significant.

**Keywords:** Innovation, process innovation, CRM.

### 1. INTRODUCTION

The business environment focuses more and more on innovations because they are an important factor for increasing competitiveness and achieving a competitive advantage. Innovation failure rates are very high and create high costs for companies (Lukes & Stephan, 2017). Therefore, it is important to understand the factors that influence or enhance innovation activities in the business environment. Customers are a key actor for companies who can provide them with information or participate with them in the joint creation of new products. Co-development, which is aligned with customer needs, will increase satisfaction, and ensure a higher likelihood of adoption of their innovations (Henard & Szymanski, 2001). The main issue in the innovation process is the effective management of customer knowledge, which includes the collection, sharing, transfer, efficient use, adaptation, and use of the same information in activities that are significant for customers. The inclusion of customers in business processes means that they become a resource of the company, which it serves to enhance its innovative capabilities (Vargo & Lusch, 2004). It is very important that the management of the company knows and understands the conditions under which cooperation with customers will lead to successful innovation. The focus of our research will be various mechanisms of cooperation with customers and their impact on process innovation. The structure of the work includes primarily a review of the literature in process innovations and cooperation with customers. Cooperation mechanisms that may be relevant for process innovation are also discussed. They include sharing information with customers, collaborative problem solving, and technology used in customer relationships. Empirical research was conducted on the territory of AP Vojvodina in the Republic of Serbia. The sample consists of companies in this area, and their general managers were responsible for filling out the survey. After that, a statistical analysis was performed, the results and conclusions were presented.

### 2. THEORETICAL BACKGROUND

The success of many companies is most often attributed to the innovations they brought with them. In modern business conditions, innovative activities have become a necessity that ensures companies' survival. They are faced with a great

need to stay ahead of global changes, pressure to produce quick results and fierce competition that is aggressively marching towards its innovative future. In addition to maintaining a competitive advantage, it is important to highlight the importance of innovation for generating economic growth (Schumpeter & Swedberg, 2021). Innovative potential needs to be used in all fields. Innovations mean the creation and implementation of ideas into new products, processes, or services, which, with their uniqueness, bring high value to those who apply them (Kamal et al. 2023).

Explaining innovations requires distinguishing them and introducing different categories of innovations. The basic division of innovations was made according to the nature and degree of changes they bring. Based on this, we have radical and incremental innovations (Dewar & Dutton, 1986). Radical innovations are obtained through significant research and experimentation, and their result is unprecedented knowledge, products and processes, whose return on investment requires a long period of time (Duodu & Rowlinson, 2021). Incremental innovations imply changes and improvement of existing products, services, processes, technologies, organizational structure, and other organizational components (de Vries & Verhagen, 2016). Depending on the nature of the innovation itself, there are different forms. In the literature, we most often encounter product and service innovations, process innovations, and organizational innovations (Goffin & Mitchell, 2016; Rahmah et al., 2020). Product innovations mean the development of new or improvement of existing products. Process innovation means the creation of new and improvement of existing processes in the company. Administrative innovations represent the introduction of novelties into the organization, which affect changes in procedures, rules, organizational structure, roles, and relationships in the organization (Naveh et al., 2006). Many researchers are interested in the relationship between product innovation and process innovation (Fritsch & Meschede, 2001; Li et al., 2007; Bergfors & Larsson, 2009). Weiss (2003) concludes that companies will favor product innovation when there is strong competitive influence and for products that have a high level of differentiation, while process innovation will be favored for less differentiated products and weaker competitive influence. Abernathy & Utterback (1978) presented a model that shows the relationship between product innovation and process innovation through the product life cycle. In the earlier stages of the life cycle, there is the greatest potential for innovation of the product itself, so product innovation is more dominant. Improvements and improvements to the product throughout its life cycle led to exhaustion of product innovation. Then the focus shifts to process innovation. Process innovation is explained as the ability of an organization to provide a better work process than the current one, thereby achieving better performance (Lei & Le, 2021). They represent the redesign of business processes, using innovative technologies and available organizational resources (Davenport, 1993). Process innovation is the most important way that enables companies to be more efficient and reduce their operating costs (Yan et al., 2024). Their potential is also reflected in the fact that they can contribute to quality improvement, ensure organizational flexibility, improve service delivery, and contribute to the achievement of organizational goals. Process innovation can come from various internal and external sources (Reichstein & Salter, 2006). In further considerations, attention will be focused on customers, as an external source of information for process innovation. Davenport (1993) points out that in addition to the competitive influence on process innovation, the incentive provided by customers is very important. Adequate customer relationship management enables customer retention and obtaining suggestions for improving products and services (Ramani & Kumar, 2008). Unsatisfied customer needs and frustrations are a valuable source of innovation. They possess unique knowledge about their preferences (Poetz & Schreier, 2012). Therefore, cooperation with them is the right way to reach innovation (Prahalad & Ramaswamy, 2004). The choice of customers for cooperation, who will provide innovative and profitable products, requires that they be representatives of that market, that is, that they face the needs of most of that market (Morrison et al., 2004). It is important to explain how and where companies should involve their consumers, to gain a better insight into them (Bratianu et al., 2023). Achieving the necessary knowledge requires the development of various cooperation mechanisms that will improve knowledge flows, facilitate cooperation, and spread innovative culture (Massingham, 2020). CRM (customer relationship management) is the use of comprehensive strategies and engineering to find, understand, acquire, and retain customers (Claycomb et al., 1999). This approach includes the activities of satisfying customers' needs, identifying their preferences, resolving complaints, providing after-sales services, and establishing long-term relationships (Sin et al., 2005). This study examines the impact on process innovation of three CRM activities, namely information sharing, collaborative problem solving, and technology-based CRM.

## **2.1. Information sharing**

Information sharing refers to the degree to which stakeholders are willing to share information with each other and thereby facilitate mutual business (Kulangara et al., 2016). It represents the interactive activities of the company and the customer through which they exchange and share information about preferences, market demand, new product introductions and sales promotion (Mentzer et al., 2000). Information exchange is a good signal to partners that there is knowledge that is of potential value to them (Husted & Michailova, 2010). There is no guarantee that every form of collaboration will contribute to innovative performance (Wang & Hu, 2020). Therefore, it is necessary to view knowledge management as a dynamic process that requires constant work and adaptation, removing the gap identified between customer expectations and aligning with customer beliefs (Bratianu, C., & Vasilache, S. (2009). Customers need to be provided with adequate feedback (Ma Prieto & Pilar Perez-Santana, 2014). Both companies and customers can benefit from sharing information (Subramaniam & Youndt, 2005; Mooi & Frambach, 2012). If information reflects the customer's current and future needs, it contributes to the innovation process (Cui & Wu, 2018). Firms improve their

innovation capacity when they increase the scope of their relationships with others is a mechanism that turns tacit knowledge into explicit knowledge, and both types of knowledge are inputs for achieving innovation (Castaneda & Cuellar, 2020). The idea is to stimulate customers to make their experience and imagination available to the company, thus becoming active partners in to the process of joint creation (Bratianu et al., 2023). Wang & Hu (2020) explained the relationship between process innovation and information sharing in the way that information sharing enables practitioners to learn. They are thus trained to solve technical problems, get new ideas, set new goals, and create new tools. They believe that sharing knowledge based on mutual trust and respect will bring long-term benefits, such as innovation and profit. The first hypothesis H1 is based on the previous analyses.

H1: Information sharing has a positive and statistically significant impact on process innovation in companies in the AP Vojvodina area in the Republic of Serbia.

## **2.2. Joint problem-solving**

Joint problem solving involves a difficult or unforeseen situation in which the company and the customer share responsibility and solve the problem together (McEvily & Marcus, 2005). Providing voluntary assistance to customers to solve problems in product design or technological process helps the company to improve product quality and improve business processes (Walter & Ritter, 2003). Those who have developed mechanisms for joint problem solving are in a better position in terms of realizing complaints, providing after-sales services, resolving customer claims and maintenance. Collaborative problem solving contributes to innovation performance because it brings about continuous improvements in products, processes, and services (Huang & Chang, 2008). This way of solving problems is doubly important for organizational innovation (Wang & Hu, 2020). First, when solving problems together, partners provide significant savings in time and investment, which are required for information gathering. Second, this process provides learning for the parties involved. New opportunities and new knowledge are often born from it. By solving problems together, customers can be significantly influenced. Acquaintance with specific problems and joint search for a solution can lead to changes in consumer habits and their procedural adjustments. This is especially characteristic of complex products where there are many restrictions and few possibilities for change. Customers will much more easily accept solutions that are not perfect and in line with their expectations when they are involved in solving the problems that the company is facing. The second hypothesis H2 is based on the previous consideration:

H2: Joint problem solving with customers has a positive and statistically significant impact on process innovation in companies in the AP Vojvodina area in the Republic of Serbia.

## **2.3. Technology based CRM**

CRM-based technologies involve the use of IT systems to offer customers technological assistance and facilitate the establishment of relationships with them. This collaboration mechanism should facilitate customer communication and understanding. Thus, the conditions are created for a faster and easier response to their needs. CRM-based technology provides data that serves to improve services and achieve customer loyalty (Ferreira et al., 2023). Today, this is very pronounced when we have the use of artificial intelligence in CRM in full swing. Kumar et al. (2023) points out that companies are developing systems that are integrated with artificial intelligence to accurately manage complex relationships and analyse customer requirements. CRM is a key tool that digitizes the business world and has a great capacity for the development of innovation (Gil-Gomez et al., 2020). When it comes to the importance of using CRM for process innovation, Wang & Hu (2020) showed that companies using CRM technologies initiate changes in production technology faster and adhere to customer specifications. The significant role of IT systems for process innovation was recognized by Valmohammadi (2017), Khosrow-Pour (2006), Tarafdar and Gordon (2007). Their considerations suggest that the use of technology in customer relations will increase the number of process innovations. This leads to the establishment of the third hypothesis H3:

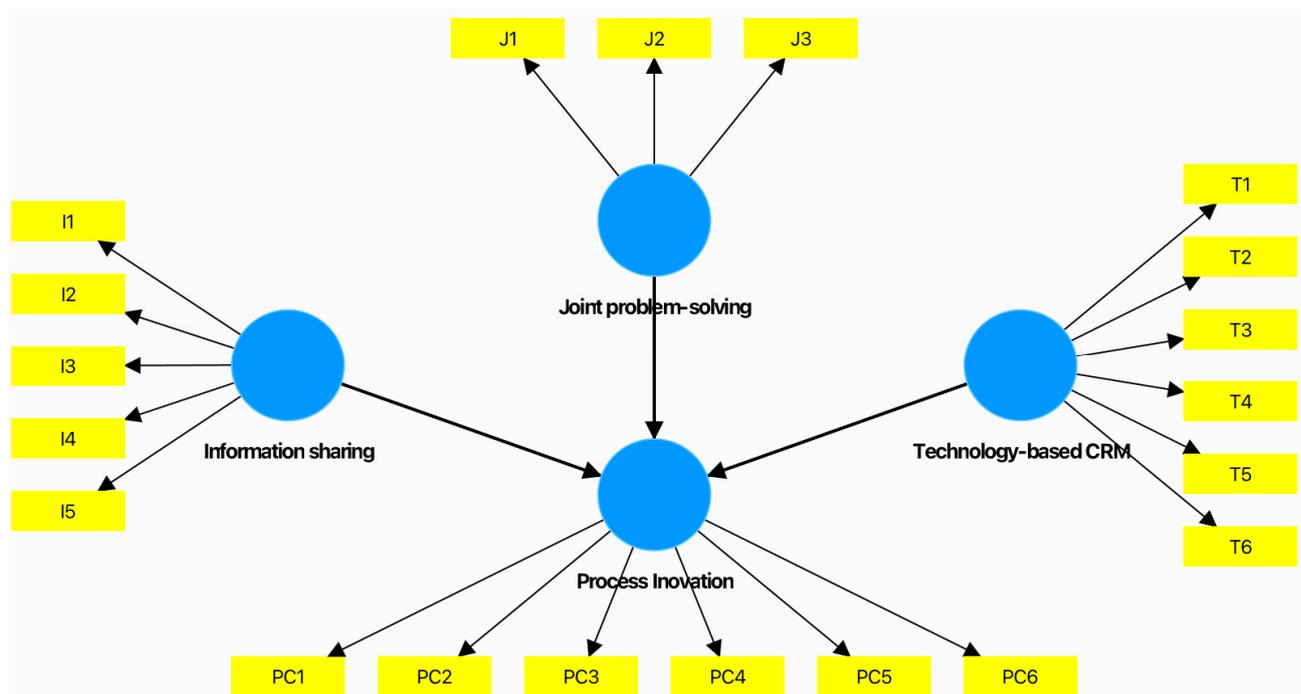
H3: Technology based CRM: with customers has a positive and statistically significant impact on process innovation in companies in the AP Vojvodina area in the Republic of Serbia.

## **3. METHODOLOGY**

The research methodology was carried out through several steps. It meant primarily defining the constructs and specifying their relationship. The database, which was used for the analysis, was obtained through research conducted on companies in the territory of AP Vojvodina in the Republic of Serbia. The idea is to examine the impact of different forms of relationship with consumers on process innovation. The research is based on a questionnaire created by Ru-Jen Lin et al. (2010). The observed dimensions of consumer relations are information sharing with consumers, joint problem solving with consumers, and the use of technology in consumer relations. Information sharing included the following indicators: *I1. Our company shares market information with customers (promotional information and competitive product information); I2. Our company shares product demand information with customers; I3. Our company shares inventory information with customers; I4. Our company jointly makes production plans with*

customers; I5. Our customers alert us to events that may affect our supply. The construct denoting joint problem solving involves the following questions: J1. Our key customers work with us to overcome difficulties (inventory management, delivery delays and logistics management); J2. Our company is jointly responsible with our key customers for getting things done; J3. Our company works with our key customers to help solve each other's problems (financing, production, and management). Indicators for technology used in customer relations are as follows: T1. Our company uses a call center or computerized telephone integration to deal with customer requests, complaints, and suggestions; T2. Our company uses SFA (Sales Force Automation) to monitor sales processes, analyze customer trade-offs, find information, find problems, and help negotiate and adjust business; T3. Our company uses MIS to collect information on customer trade-offs and to integrate the database; T4. Our company has constructed an integrated CRM performance evaluation system; T5. Our company establishes a perfect web-based customer interaction; T6. Our company uses data warehousing and data mining to store customer information to identify which potential customers are more valuable. 31 companies on the territory of AP Vojvodina were included in the research. The companies in the sample come from different business sectors. When looking at the number of employees, eighteen companies have up to 50 employees, while the remaining thirteen companies have over 50 employees. Fifteen companies have been around for over twenty years, while the other sixteen are younger. Based on this, it can be concluded that a balance has been made regarding the number of employees, age of the company and business sectors.

The model was analyzed using the Smart PLS 14 software tool. The conceptual model is shown in Figure 1.



Picture 1: Conceptual model  
Source: Authors, 2024

## 4. RESULTS

Estimates of constructs for the main model were performed by examining the reliability of individual indicators, reliability of internal consistency, convergent validity and discriminant validity.

The reliability of the indicators was checked by evaluating the standardized loadings of the indicators. Only I1 and PC1 did not have a higher value than 0.7. Therefore, they were excluded from further analysis. Other values were greater than 0.7 for all indicators, which satisfied the reliability of the indicators. For internal consistency reliability and convergent validity, all reflective constructs had satisfactory levels of composite reliability (Cronbac'h alpha) above 0.7 and AVE above 0.5. Below is a table showing the quality of the reflective construction.

Table 2: Quality criteria of reflective constructs

Constructs	Outer loadings	AVE	Cronbac'h alpha
Information sharing		0.682	0.848
I2	0.764		
I3	0.851		
I4	0.776		
I5	0.906		

Joint-problem solving		0.620	0.853
J1	0.879		
J2	0.725		
J3	0.745		
Technology based CRM		0.691	0.910
T1	0.783		
T2	0.823		
T3	0.802		
T4	0.916		
T5	0.822		
T6	0.836		
Process innovation		0.618	0.692
PC2	0.854		
PC3	0.785		
PC4	0.785		
PC5	0.717		
PC6	0.790		

Source: Authors, 2024.

The results of the discriminant validity test are shown in the following table. When it comes to discriminant validity, the Fornell-Larcker and Heterotrait-monotrait ratio (HTMT) criteria were established. Discriminant validity was considered from the aspect of Heterotrait-monotrait ratio (HTMT) criteria. From the attached table, it can be seen that the condition of discriminant validity is met.

**Table 3:** Discriminant validity - Heterotrait - monotrait ratio (HTMT)

Information sharing	Information sharing	Process innovation	Technology based CRM	Joint-problem solving
Process innovation	0.388			
Technology based CRM	0.200	0.637		
Joint-problem solving	0.619	0.568	0.130	

Source: Authors, 2024.

A bootstrapping procedure with 5000 subsamples was used to examine the path coefficients. As seen in Table 4, all path coefficients were positive and statistically significant at  $p < 0.05$ , with VIF values below 3 indicating no collinearity issues.

**Table 4:** Path coefficients and VIF values

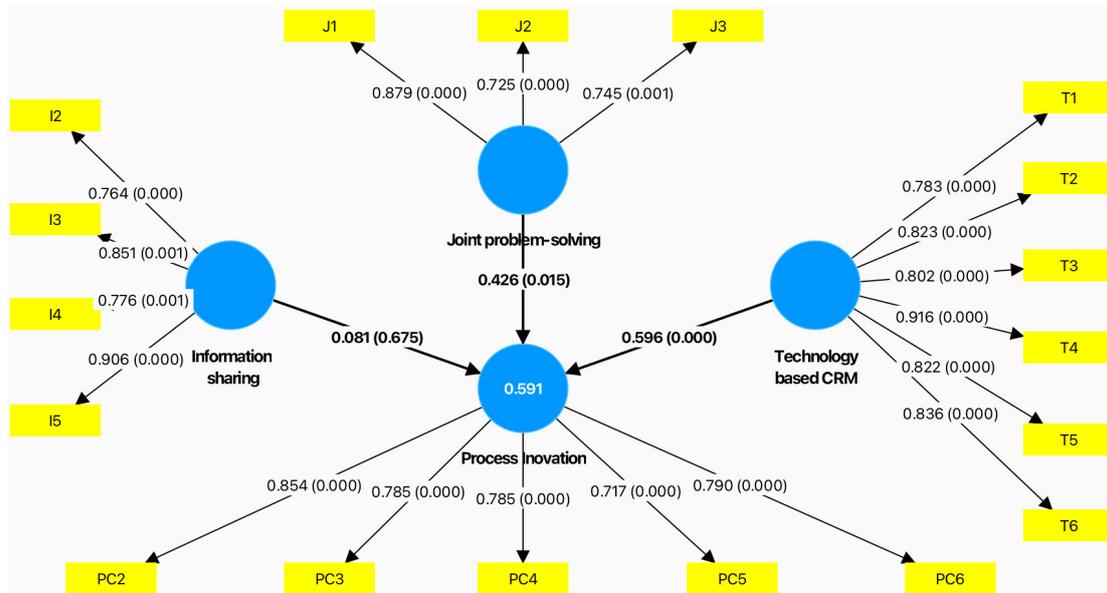
	Path coefficients	Standard deviation	T statistics	P values	VIF
Information sharing -> Process innovation	0,081	0,193	0,419	0,675	1,354
Technology based CRM -> Process innovation	0,596	0,105	5,651	0,000	1,048
Joint-problem solving -> Process innovation	0,426	0,175	2,440	0,015	1,308

Source: Authors, 2024.

Bearing in mind all the previous comments, it can be emphasized that it has been proven that the instrument can be used in the analysis, when it comes to testing the main model of this research.

The coefficients for PLS-SEM relationships, their level of significance and the R2 value are shown in Figure 1. The value of R2 is 0.591, which means that 59.1% of the variance of process innovation is explained by lower-level constructs. The coefficients representing the relationships between lower-level reflective constructs and process innovation are positive and statistically significant with  $p < 0.05$ , for joint problem solving (0.015) and for technology (0.002).

When it comes to the impact of information sharing on process innovation, the coefficient was (0.675) with  $p < 0.01$ , which means that it is a positive relationship that is not statistically significant.



**Picture 2: PLS-SEM relations**  
**Source: Authors, 2024**

## 5. DISCUSSION AND CONCLUSION

Innovations are essential to achieving a competitive advantage because they provide companies with flexibility that helps them adapt to change more easily. Process innovations represent procedural changes in production, to achieve better results and improve products and services for customers. Companies often rely on customers as sources to enhance their innovative potential. Our research aimed to determine how cooperation with customers affects process innovation. Cooperation with customers refers to various mechanisms through which it can be implemented. These include information sharing with customers, joint problem solving and technology-based CRM. Based on the obtained results, information sharing has a positive effect on process innovation, but that this relationship is not statistically significant. This means that hypothesis H1 is not confirmed. This result does not support the consulted literature on this topic. Carr & Pearson (1999) point out that information sharing will lead to the adoption of new technologies by manufacturers, which will affect design and business processes. Lin et al. (2010) says that there is a positive effect of information sharing on product and process innovation. We look for the explanation of such results in several places. We primarily focus on the sample and the area where the research is conducted. In this area, the awareness of the benefits of open innovation and cooperation with external actors on the market is not yet sufficiently pronounced. Disclosure and sharing of important information are not characteristic of these companies, due to the fear that the competition will not get to them. In addition, we seek justification in the nature of the innovations, which were chosen to be observed in relation to cooperation. Since it is about process innovation, we start from the fact that customers are not sufficiently ready and expert to suggest and provide useful information, which could lead the company to innovation in the process itself. Hypotheses H2 and H3 were fully confirmed. When we talk about joint problem solving, it is concluded that it increases the probability of process innovation. Huang & Chang (2008) and Wang & Hu (2020) reach the same conclusions. Unlike information sharing, joint problem solving represents a higher degree of cooperation. First, joint resolution tells us that it is a joint business that is often formalized with certain documentation and for which there is a certain interest of both parties. Based on that, the responsibility of interested parties is greater, and therefore the willingness and freedom to disclose confidential information. In the end, joint solving implies that all actors are familiar with the technological process, understand the position of the company and the problems it faces. Therefore, process innovation is much more likely to occur within a joint problem-solving process because the parties are contractually secured, bound, accountable and familiar with all the details of the technological process. Technology-based CRM has proven to be a mechanism that increases the likelihood of increasing process innovation in companies. Agreement with these findings is found in many works (Gil-Gomez et al., 2020; Wang & Hu 2020; Valmohammadi, 2017; Khosrow-Pour, 2006; Tarafdar & Gordon, 2007). This technology enables the creation of significant databases, which can be a source of diverse information for all segments of the company. It is only important to find an adequate application of that data.

The practical application of the results of this research can be seen in situations where companies want to influence their innovation activity. Important mechanisms are presented and their importance for process innovations is explained. The contribution can also be seen through the increase of literature in the field of innovation and marketing and can serve as a landmark for subsequent research. The limitation of the work that can be cited as the most important is the size of the sample itself, followed by the fact that the respondents come from different sectors, which is not very useful when using a small sample. Another limitation is that not all customer cooperation mechanisms are covered.

Recommendations for further research are as follows. First, it is necessary to increase the sample and perform the analysis according to sectors. Inclusion of other mechanisms that make up the relational context. In addition, it would be good to look at the impact of customer relations on other types of innovation.

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# **Session**

# **2**



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**Dragica Odzaklieska**

“St. Kliment Ohridski” University - Bitola  
 Faculty of Economics - Prilep  
 Prilep, North Macedonia

dragica.odzaklieska@uklo.edu.mk

**Ilija Hristoski**

“St. Kliment Ohridski” University - Bitola  
 Faculty of Economics - Prilep  
 Prilep, North Macedonia

ilija.hristoski@uklo.edu.mk

**Tatjana Spaseska**

“St. Kliment Ohridski” University - Bitola  
 Faculty of Economics - Prilep  
 Prilep, North Macedonia

tatjana.spaseska@uklo.edu.mk

## MACROECONOMIC DETERMINANTS OF CORPORATE DEBT: EVIDENCE FROM NORTH MACEDONIA

**Abstract:** Several important factors affect the financing of companies in North Macedonia today. The paper aims to explore how the Gross Loans to Non-Financial Sector / GDP ratio depends on the Inflation Rate, the Interest Rate of Non-financial Sector Loans, and the GDP. Based on the secondary data (quarterly time series) obtained from credible sources covering the period from 2015:Q1 to 2023:Q3, we employ the Auto-Regressive Distributed Lag (ARDL) approach to examine both the short- and long-run dependencies. The results confirm the statistically significant impact of the regressors on the dependent variable.

**Keywords:** Corporate debt, inflation, interest rate, GDP, ARDL methodology

### 1. INTRODUCTION

The corporate sector plays a pivotal role in generating gross domestic product and employment rates, thereby serving as a primary driver of economic growth. However, the success of the corporate sector is largely contingent upon access to financing. Financing is a critical and complex process essential for the survival, growth, and effective management of companies. However, securing reliable financing sources poses a significant challenge, directly impacting companies' strength and stability. In North Macedonia, companies typically exhibit a smaller structure, limiting their access to alternative financing options. Non-banking financial institutions play a modest role in funding the domestic corporate sector, and the use of debt financing through the domestic capital market is virtually non-existent. Consequently, credit funds emerge as the predominant source for supporting companies' operational and developmental activities. This scenario is further exacerbated by several significant macroeconomic and geopolitical events that adversely affect corporate financing. Notably, these include the military conflict between Russia and Ukraine, disruptions in global supply chains, escalating inflation, and increasing interest rates. According to the Financial Stability Report by the National Bank of the Republic of North Macedonia, the total debt within the domestic corporate sector has shown a consistent increase over recent years, culminating in a figure of 565,019 million Macedonian denars (MKD) at the close of 2022 (NBRNM, 2022a, pp. 69–71). Concurrently, the domestic debt attributed to the corporate sector has also seen an uptrend, reaching 232,408 million MKD by the end of 2022. This surge in borrowing needs is largely attributable to several factors, including the steep rise in energy prices, a considerably high inflation rate, and an overall escalation in operational expenses. For instance, within the Central and Southeast Europe region, the average inflation rate for 2022 stood at 13.3%. In comparison, the European Union recorded an inflation rate of 9.0%, while our country reported a higher figure of 14.2% (NBRNM, 2022b, p. 4). All these conditions have significantly elevated companies' financial needs, leading them to heavily rely on credit financing. Additionally, a considerable portion of the debt portfolio (47%) is subject to variable interest rates, underscoring the sector's vulnerability to interest rate risk. This factor becomes particularly critical amidst the current scenario of rising interest rates and the subsequent tightening of monetary policy. Given the lesser focus on corporate debt relative to public debt, despite both being major contributors to global indebtedness, the main goal of this study is to analyze the impact of macroeconomic determinants (i.e., interest rate,

inflation rate, and GDP) on the amount of corporate debt of the non-financial sector, specifically by analyzing the non-financial corporate debt-to-GDP ratio.

The remainder of the paper is organized as follows: Section 2 offers an overview of prior research pertinent to the topic. Section 3 details the data and methodology employed in this study and presents the results obtained. Section 4 interprets and discusses these findings. The final section concludes the paper and suggests directions for future research.

## 2. RELATED RESEARCH

The level of global debt experienced a significant surge following the 2008-09 global financial crisis. Global debt, encompassing the nonfinancial corporate sector, financial sector, government, and household debt, rose from 292% of the world's gross domestic product (GDP) in 2008 to 318% by 2018. Notably, nonfinancial corporate and government debt were primary drivers of the increase in global debt post-global financial crisis. Specifically, the ratio of nonfinancial corporate and government debt to GDP climbed from 78% to 92% and from 62% to 86%, respectively, during the period from 2008 to 2018, as reported by the Institute of International Finance (IIF) in 2019 (Abraham, Cortina, & Schmukler, 2020). In 2023, the global debt increased by over \$15 trillion, reaching a record peak of \$313 trillion. Despite this surge, the global debt-to-GDP ratio fell for the third consecutive year, primarily due to the performance of mature markets (IIF, 2024). Abraham, Cortina, & Schmukler (2020, p. 1) observed that in the aftermath of the global financial crisis, nonfinancial corporate debt experienced a significant rise, particularly in emerging economies. They pointed out that from 2008 to 2018, the ratio of corporate debt to gross domestic product (GDP) in these economies almost doubled, increasing from 56% to 96%. In contrast, this debt-to-GDP ratio remained relatively unchanged in developed economies during the same period. Therefore, during the decade following the global financial crisis, characterized by low interest rates, companies across various nations substantially increased their borrowing from banks and the financial markets. Indicators traditionally used to gauge excessive lending in corporate markets, such as the proportion of high-yield bond issuance, the prevalence of loans with minimal financial safeguards (covenant-lite lending), and the issuance of financial instruments backed by corporate loans (collateralized loan obligations or CLOs), have at times signaled concern. Additionally, while the availability of credit grew rapidly, the financial market's pricing of corporate credit risk dropped significantly. This decline in credit spreads, despite increased borrowing volumes and more lenient loan terms, suggested to many observers that a boom in corporate credit, driven by an oversupply, was underway. Such a boom, they feared, could exacerbate the impact of a future economic downturn (Wiltermuth & Haunss, 2019). According to the same source, some analysts argue that the rise in nonfinancial corporate debt could be viewed positively, suggesting that it indicates firms facing fewer financial constraints, enabling them to secure additional funds for profitable investment ventures and expansion. Moreover, accessing new funding beyond traditional banking channels could aid firms in diversifying their financing channels and bolstering their resilience against financial crises. Conversely, other studies suggest that the surge in nonfinancial corporate debt poses a threat to the global economy. In 2019, the United Nations recognized high nonfinancial corporate debt levels as one of the factors that could impair economic growth (UN, 2019). The escalation in nonfinancial corporate debt levels aligned with a period of diminishing investment and economic growth in emerging economies (WB, 2018). As a consequence, many researchers have strived to analyze the relationship between corporate debt and economic growth. The results of these studies have confirmed both positive and negative relationships. Hanousek and Shamshur (2011) discovered a negative, yet significant relationship between GDP and debt. On the contrary, Kayo and Kimura (2011) concluded that there is a positive and significant relationship between the GDP growth rate and debt.

Regarding the relationship between corporate debt and interest rates, as well as inflation rates, many researchers have confirmed that elevated levels of interest rates and inflation can indeed lead to higher debt-value ratios. Goodhart *et al.* (2022) demonstrated that elevated levels of corporate debt could hinder the transmission of monetary policy, rendering it less effective in controlling inflation both qualitatively and quantitatively. Their study revealed that the existence of legacy corporate debt undermines the ability of contractionary monetary policy to rein in inflation, and that increased debt results in a lesser reduction in inflation following monetary contractions. This outcome is contingent upon the income effect of corporate debt, impacting both aggregate demand and supply. Regarding the relationship between interest rates and corporate debt, modern macroeconomics suggests that the interest rate is a significant determinant of debt. A low interest rate in the economy encourages firms to utilize more debt, while a higher interest rate tends to discourage borrowing. In their research, Deesomsak, Paudyal, and Pescetto (2004) concluded that interest rates have a significant positive influence on debt levels.

## 3. DATA, METHODOLOGY, AND RESULTS

### 3.1. Data

The data utilized comprises quarterly time series, spanning from 2015:Q1 to 2023:Q3, resulting in a total of 35 observations. Our analysis focuses on a single dependent variable and four independent variables, outlined as follows:

- *Dependent variable*
  - Gross Loans to Non-Financial Sector/GDP ratio (*GLOANS2GDP*), in percentages [%], as a measure of corporate debt;
- *Independent variables*
  - Inflation Rate (*INFLRATE*), in percentages [%], as a measure of macroeconomic stability;
  - Interest Rate of Non-Financial Sector Loans (*INTRATE*), in percentages [%], as a measure of macroeconomic stability;
  - Real Gross Domestic Product (*GDP*), given at current prices in millions of Macedonian denars [MKD], as a measure of the economic activity in the country;
  - A dummy variable (*DUMMY*), which takes a value of 0 (zero) for the period from 2015:Q1 to 2020:Q1 and again from 2023:Q1 to 2023:Q3, and a value of 1 (one) for the period from 2020:Q2 to 2022:Q4; It is being introduced as a fixed regressor to capture the cumulative economic impacts of the COVID-19 crisis and consequently, the Russian-Ukrainian conflict on the Macedonian economy; its values have been estimated based on the analysis of graphical representations of variables *GLOANS2GDP* and *INFLRATE*, where the structural disturbances were the most obvious.

All the data used in this research have been exploited from secondary sources only, i.e. the data for the dependent variable *GLOANS2GDP* were obtained from the Statistical Web Portal of the National Bank of Republic of North Macedonia (NBRNM, –) and from the State Statistical Office official website (MAKStat Database, –), the data for *INTRATE* were obtained from the Statistical Web Portal of the National Bank of Republic of North Macedonia (NBRNM, –), the data for *INFLRATE* were taken over from the Macedonian Ministry of Finance’s website (MoF, –), whilst the data about GDP were taken over from the State Statistical Office web pages (MAKStat Database, –).

### 3.2. Methodology

To determine the impact and the magnitude of the chosen independent macroeconomic determinants on the corporate debt, the initial regression equation we are estimating, in its most rudimentary form, can be specified as follows (Eq. 1):

$$GLOANS2GDP = f(INFLRATE, INTRATE, GDP, DUMMY) \quad (1)$$

The order of integration of each of the individual variables has been determined using two tests, the Augmented Dickey-Fuller Test (ADF Test) (Dickey & Fuller, 1979) and the Phillips-Perron Test (PP Test) (Phillips & Perron, 1988).

The optimal lag order selection has been conducted after estimating the unrestricted/standard Vector Auto-Regressive (VAR) model using five criteria: the sequential modified LR test statistic (LR criterion), the Final Prediction Error (FPE criterion), the Akaike Information Criterion (AIC), the Schwarz Information Criterion (SIC), and the Hannan-Quinn Information Criterion (HQ). In the specification of the unrestricted/standard VAR model and all other analyses, we have used the original time series data (i.e. raw data) of endogenous variables *GLOANS2GDP*, *INFLRATE*, *INTRATE*, and *GDP*, as well as the variable *DUMMY* and *C* as exogenous variables, because this approach preserves the original characteristics of the data, allowing the analysis of how changes in the actual variables are related over time, including any real long-term trends and seasonal patterns. Our intention was not exploration of the short-term dynamics or the relationship among variables after removing the effects of trends and seasonal cycles.

The analysis of the impact of independent variables on the dependent variable is being carried out by building and evaluating a corresponding ARDL (Auto-Regressive Distributed Lag) model (Pesaran & Shin, 1998; Pesaran *et al.*, 2001).

The general ARDL( $p, q_1, q_2, q_3$ ) regression model, regarding its four-variable representation (the variable *DUMMY* is a fixed regressor without time lags), which is comprised of a dependent variable,  $Y_t$ , and three regressors,  $X_{k,t}$ ,  $k = 1, \dots, 3$ , is given by Eq. 2:

$$\begin{aligned} \Delta Y_t = & \beta_0 + \sum_{i=1}^p \lambda_i \cdot \Delta Y_{t-i} + \\ & + \sum_{j=0}^{q_1} \delta_{1j} \cdot \Delta X_{1,t-j} + \sum_{j=0}^{q_2} \delta_{2j} \cdot \Delta X_{2,t-j} + \sum_{j=0}^{q_3} \delta_{3j} \cdot \Delta X_{3,t-j} + \\ & + \varphi_1 \cdot Y_{t-1} + \varphi_2 \cdot X_{1,t-1} + \varphi_3 \cdot X_{2,t-1} + \varphi_4 \cdot X_{3,t-1} + \varepsilon_t \end{aligned} \quad (2)$$

where:

- $Y_t$  is the dependent variable;
- $X_{k,t}$ ,  $k = 1, \dots, 3$ ; are the three independent variables;
- $\Delta$  is the first-differencing operator;

$p \geq 1$  is the optimal number of lags for the dependent variable;  
 $q_k \geq 0, k = 1, \dots, 3$ ; are the optimal number of lags for the three independent variables;  
 $Y_{t-i}, i = 1, 2, \dots, p$ ; are the lagged values of the dependent variable;  
 $X_{k,t-j}, j = 0, 1, 2, \dots, q_k; k = 1, \dots, 3$ ; are the lagged values of the three independent variables;  
 $\beta_0$  is a constant (intercept);  
 $\lambda_i, i = 1, 2, \dots, p$ ; are the short-run coefficients of dependent variables;  
 $\delta_{kj}, j = 0, 1, 2, \dots, q_k; k = 1, \dots, 3$ ; are the short-run coefficients of the three independent variables;  
 $\varphi_1$  is the long-run coefficient of the dependent variable;  
 $\varphi_p, p \in \{2, 3, 4\}$ ; are the long-run coefficients of the three independent variables;  
 $\varepsilon_t$  is the disturbance (white noise) term.

Since it turned out that the time series are integrated of different orders (either I(0) or I(1)), the Bounds Cointegration Test (i.e. F-Bounds Test) was conducted to estimate the absence (hypothesis H0) or presence (hypothesis H1) of cointegration among the variables. It was performed choosing “ARDL – Auto-regressive Distributed Lag Model” as a method, with variables *GLOANS2GDP*, *INFLRATE*, *INTRATE*, and *GDP* used as dynamic regressors, the variable *DUMMY* used as a fixed regressor, and choosing the option “1. None” in the Trend specification field, since the level of integration of the variables was previously determined for the option “Without Constant & Trend”.

The rest of the analysis was conducted using the Auto-Regressive Distributed Lag (ARDL) methodology with  $p_{opt} = 4$  lags by estimating the ARDL(1, 3, 4, 4) model and also with  $p_{opt} = 3$  lags by estimating the ARDL(3, 1, 3, 3) model. Each of these two regression models has been estimated taking into account the following five options: (1) Option #1. No intercept or trend in cointegrating equation (CE) or test VAR; (2) Option #2. Intercept (no trend) in CE – no intercept in VAR; (3) Option #3. Intercept (no trend) in CE and test VAR; (4) Option #4. Intercept and trend in CE – no intercept in VAR; and (5) Option #5. Intercept and trend in CE – intercept in VAR. In both cases, it turned out that the best model fit is obtained using “Option #1. No intercept or trend in cointegrating equation (CE) or test VAR”.

Based on the findings of the Bounds Test of Cointegration, the Error Correction Model (ECM) of the regression equation (2) has been used for estimating the coefficients of the long-run equilibrium among the variables of interest, based on a VAR model with 4 lags ( $p_{opt} = 4$  lags) and Option #1. No intercept or trend in cointegrating equation (CE) or test VAR.

As a constituent part of the analysis of the ECM, we have checked two types of causality relationships: the long-run and the short-run causality:

- *The long-run causality*; In economics, the term “long-run” denotes a theoretical concept centered around equilibrium, referring to a period during which all economic variables of interest are flexible and have adequate time to adjust. The concept of long-run causality emphasizes the importance of the Error Correction term within the ECM (Error Correction Model) equation.
- *The short-run causality*; The short-run encapsulates the notion that an economy’s response to various stimuli varies based on the time it has to adjust. The concept of the short-run is not tied to a specific timeframe; instead, it depends on the economic variable in question. In the short-run, the economic variables being studied are unable to fully adjust to reach a new equilibrium, i.e. a state where opposing forces are in balance. The short-run causality relationship is determined by evaluating the joint significance of the lags of a specific first-differenced variable within the ECM (Error Correction Model) equation, typically assessed using the Wald test.

Finally, the resulting ECM underwent diagnostic checks on the residuals. Specifically, we tested the residuals for the presence of serial correlation (autocorrelation) using the Breusch-Godfrey Serial Correlation LM Test, heteroscedasticity (using the Breusch-Pagan-Godfrey Heteroskedasticity Test), and normality of distribution (using the Jarque-Bera Test). The stability of the overall model has been proved using the CUSUM Test and CUSUM of Squares Test).

All the analyses have been carried out using the econometric package EViews v10.

### 3.3. Results

Since the results of the Augmented Dickey-Fuller (ADF) test for both Schwarz Information Criterion (SIC) and Akaike Information Criterion (AIC) were not conclusive for variables *INFLRATE* and *INTRATE* because both of them exhibited obvious trends in their raw format, we have used their de-trended time series (*INFLRATE\_DT* and *INTRATE\_DT*) to determine their order of integration. The de-trending operation was carried out using the Hodrick-Prescott (HP) Filter where the smoothing parameter  $\lambda = 1,600$  (for quarterly time series). In addition, the variable *GDP* exhibited both seasoning and trending features in its raw format, so the de-seasoned and de-trended time series (*GDP\_DSDT*) was used for conducting the ADF and PP tests. The de-seasoning operation was conducted using the STL Decomposition (Seasonal-Trend decomposition using LOESS). Table 1 contains a summary of the ADF and PP tests vis-à-vis the variables’ order of integration.

**Table 1:** Summary of the ADF and PP tests

Option	Information criterion	Test	Variables			
			GLOANS2GDP	INFLRATE_DT	INTRATE_DT	GDP_DSDT
Without Constant & Trend	Akaike Information Criterion (AIC)	PP	I(1)***	I(0)**	I(1)***	I(0)***
		ADF	I(1)***	I(0)**	I(0)**	I(0)***
	Schwarz Information Criterion (SIC)	PP	I(1)***	I(0)**	I(1)***	I(0)***
		ADF	I(1)***	I(0)***	I(0)***	I(0)***

Notes on the level of significance: (\*) Significant at the 10%; (\*\*) Significant at the 5%; (\*\*\*) Significant at the 1%;

Source: The authors, EViews v10 output

Assuming the option “Without Constant & Trend”, both the ADF and PP tests, using the AIC and SIC criteria confirm that two of the variables (*INFLRATE\_DT* and *GDP\_DSDT*) are stationary at level, i.e. their order of integration is I(0), the variable *GLOANS2GDP* becomes stationary after being first differenced, i.e. I(1), and the variable *INTRATE\_DT*, according to the ADF test, is stationary at level, i.e. I(0), while according to the PP test it becomes stationary after being first differenced, i.e. I(1). Because the variables of interest are integrated of different orders, i.e. some of them are stationary at level and others become stationary after being first-differenced, the Auto-Regressive Distributed Lag (ARDL) model can be constructed.

The results of the VAR lag order selection criteria show that the estimations of three out of five lag order selection criteria (i.e. LR, FPE, and SC) indicated the value Lag = 3 as an optimal lag length, whilst the rest two lag order selection criteria (i.e. AIC and HQ) suggest the value Lag = 4 as an optimal lag length. Since two different values for an optimal lag length were suggested, we have continued our study by constructing two different ARDL models, one with  $p_{opt} = 4$  lags, and another one with  $p_{opt} = 3$  lags. In the first case, we have estimated the ARDL(1, 3, 4, 4) model, whilst in the second one we have estimated the ARDL(3, 1, 3, 3) model. In both cases we have taken into account Option #1, “No intercept or trend in cointegrating equation (CE) or test VAR”. The direct comparison of the basic statistics between the two models showed that the ARDL(1, 3, 4, 4) model fits better the time series data (R-squared = 96,84%, Adjusted R-squared = 93.68%, AIC = 2.505796) than the ARDL(3, 1, 3, 3) model, as portrayed by numbers given in Table 2. As a result, the rest of this subsection will refer solely to the ARDL(1, 3, 4, 4) model.

**Table 2:** Comparative analysis of the two ARDL models

Max. number of lags	$p_{opt} = 4$	$p_{opt} = 3$
Model	ARDL(1, 3, 4, 4)	ARDL(3, 1, 3, 3)
Number of models evaluated	500	192
R-squared	0.968422	0.911968
Adjusted R-squared	0.936844	0.848390
Durbin-Watson statistics	2.517215	2.033564
Akaike info criterion	2.505796	3.342144

Source: The authors, EViews v10 output

The results of the F-Bounds Test show that the calculated F-statistic is equal to 10.66373, which is higher than the critical values of the upper bound I(1) at all levels of significance (10%, 5%, 2.5%, and 1% level of significance), i.e. higher than the critical values of 3.10, 3.63, 4.16, and 4.84, respectively. This means that the null hypothesis H0, claiming that there is no cointegrating relationship, can be rejected in favor of H1 at all levels of significance, which implies that the variable *GLOANS2GDP* is cointegrated with *INFLRATE*, *INTRATE*, and *GDP* in the long-run, i.e. all variables share a common stochastic trend, moving together in proportion over the long term. Consequently, even if short-term shocks affect the movements of individual series, they will converge over time. The presence of a long-term relationship among the variables suggests that their time series are interconnected and can be linearly combined in the long-run. This enables not only the estimation of a short-term ARDL model but also the estimation of a long-term Error Correction Model (ECM).

The coefficient of the cointegrating equation (−0.720088) is both negative and statistically significant (p-Value = 0.0000 ≤ 5%), as shown in Table 3. It means that there is a long-run Granger causality running from all the regressors to *GLOANS2GDP*. The speed of the adjustment from a short-run towards long-run equilibrium is 72.01%, i.e. the system corrects its previous period of disequilibrium at a speed of 72.01% within one period of time (a quarter).

**Table 3:** Statistics of the coefficient of the cointegration equation

Variable	Coefficient	Std. Error	t-Statistics	Prob.
CointEq(−1)	−0.720088	0.100649	−7.154434	0.0000

Source: The authors, EViews v10 output

The specification of the ARDL(1, 3, 4, 4) model is presented by Table 4.

**Table 4:** Details of the ARDL(1, 3, 4, 4) specification

Variable	Coefficient	Std. Error	t-Statistics	Prob.
GLOANS2GDP(-1)	0.279912	0.123657	2.263613	0.0389
INFLRATE	0.392164	0.237359	1.652199	0.1193
INFLRATE(-1)	-1.146715	0.444622	-2.579079	0.0210
INFLRATE(-2)	-0.070331	0.423413	-0.166104	0.8703
INFLRATE(-3)	0.723865	0.342698	2.112257	0.0518
INTRATE	9.618357	2.626150	3.662532	0.0023
INTRATE(-1)	-5.391390	2.642863	-2.039981	0.0594
INTRATE(-2)	-11.43068	3.576639	-3.195928	0.0060
INTRATE(-3)	-2.376933	8.484757	-0.280142	0.7832
INTRATE(-4)	11.11965	6.249519	1.779281	0.0955
GDP	6.26E-06	2.01E-05	0.312125	0.7592
GDP(-1)	4.34E-05	1.81E-05	2.402521	0.0297
GDP(-2)	3.95E-05	1.45E-05	2.721562	0.0158
GDP(-3)	-1.70E-05	1.67E-05	-1.021866	0.3230
GDP(-4)	8.74E-05	2.07E-05	4.227189	0.0007
DUMMY	4.138704	0.961516	4.304355	0.0006

Source: The authors, EViews v10 output

The long-run coefficients and the Error Correction (EC) term are presented in Table 5.

**Table 5:** Long-run coefficients and the Error Correction (EC) term

Levels Equation				
Case 1: No Constant and No Trend				
Variable	Coefficient	Std. Error	t-Statistics	Prob.
INFLRATE	-0.140283	0.321236	-0.436696	0.6686
INTRATE	2.137237	0.272829	7.833602	0.0000
GDP	0.000222	1.37E-05	16.20767	0.0000
EC = GLOANS2GDP - (-0.1403*INFLRATE + 2.1372*INTRATE + 0.0002*GDP)				

Source: The authors, EViews v10 output

The residuals diagnostic tests have led to the following findings:

- Based on the Breusch-Godfrey Serial Correlation LM Test (Prob. Chi-Square(2) = 0.1405 > 10%), the null hypothesis of no serial correlation in the residuals up to two lags is accepted at a 10% significance level;
- Similarly, according to the Breusch-Pagan-Godfrey Heteroskedasticity Test (Prob. Chi-Square(16) = 0.8201 > 10%), the null hypothesis of no heteroskedasticity in the residuals up to 16 lags is accepted at a 10% significance level;
- Additionally, the Jarque-Bera Test (Prob. = 0.507404 > 10%) indicates that the null hypothesis of normally distributed residuals is accepted at a 10% significance level.

The residual diagnostics indicate that the ECM is appropriately specified for hypothesis testing and forecasting. Furthermore, CUSUM and CUSUM of Squares test plots fall within the 5% critical bounds, confirming the stability of the ARDL model coefficients, ensuring structural stability.

## 4. DISCUSSION

Based on the specification of the ARDL(1, 3, 4, 4) model presented in Table 5, in the short-run:

- The first lag of the dependent variable *GLOANS2GDP* has a positive (+0.279912) and statistically significant influence (p-Value = 0.0389 ≤ 5%) on the current value of *GLOANS2GDP* at 5% level of significance;
- At level, the value of the variable *INFLRATE* (+0.392164), as well as its third lag (+0.723865) positively affect the current value of *GLOANS2GDP*; In addition, the impact of the third lag is statistically significant at 10% level of significance (p-Value = 0.0518 ≤ 10%); However, the first (-1.146715) and the second lag (-0.070331) of the variable *INFLRATE* negatively affect the current value of *GLOANS2GDP*; The impact of the first lag of *INFLRATE* is statistically significant at 5% level of significance (p-Value = 0.0210 ≤ 5%);
- At level, the value of the variable *INTRATE* positively (+9.618357) and statistically significantly affects the current value of *GLOANS2GDP* at 1% level of significance (p-Value = 0.0023 ≤ 1%); Also the fourth lag of *INTRATE* positively (+11.11965) and statistically significantly affects the current value of *GLOANS2GDP* at

10% level of significance ( $p\text{-Value} = 0.0955 \leq 10\%$ ); The impacts of the first, second, and the third lag of *INTRATE* are all negative ( $-5.391390$ ,  $-11.43068$ , and  $-2.376933$ , respectively); Moreover, the first and the second lag of *INTRATE* are statistically significant at 10% ( $p\text{-Value} = 0.0594 \leq 10\%$ ) and 1% ( $p\text{-Value} = 0.0060 \leq 1\%$ ), respectively;

- At level, the value of the variable *GDP* positively ( $+0.00000626$ ), but statistically insignificantly affects the current value of *GLOANS2GDP*; The first, the second, and the fourth lag of *GDP* both positively ( $+0.0000434$ ,  $+0.0000395$ , and  $+0.0000874$ ) and statistically significantly affect the current value of *GLOANS2GDP* at 5%, 5%, and 1% level of significance, respectively ( $p\text{-Value} = 0.0297 \leq 5\%$ ;  $p\text{-Value} = 0.0158 \leq 5\%$ ; and  $p\text{-Value} = 0.0007 \leq 1\%$ ); The third lag of *GDP* negatively, yet statistically insignificantly affects the current value of *GLOANS2GDP*;
- At level, the value of the dummy variable *DUMMY* positively ( $+4.138704$ ) and statistically significantly ( $p\text{-Value} = 0.0006 \leq 1\%$ ) affects the current value of *GLOANS2GDP* at 1% level of significance;
- Based on the Chi-square Test statistics obtained by the application of the Wald Test on variables' time lags, it can be concluded that there are short-run Granger causalities running from each variable's time lags toward the target variable *GLOANS2GDP*, i.e. each group of time lags of inherent to independent variables can jointly influence the current value of *GLOANS2GDP* in a short-run.

The diverse statistical significance of lag coefficients suggests complex dynamics among observed variables, including non-relational relationships. The relationship between the dependent and independent variables evolves over time, with varying lags exerting different degrees of influence and magnitudes.

On the other hand, based on the results given in Table 7, in the long-run:

- One of the regressors (*INFLRATE*) has a negative ( $-0.140283$ ), yet statistically insignificant impact on the target variable *GLOANS2GDP*;
- Two regressors (*INTRATE* and *GDP*) have a positive impact on *GLOANS2GDP* ( $+2.137237$  and  $+0.000222$ , respectively);
- The impacts of independent regressors *INTRATE* and *GDP* on the dependent variable *GLOANS2GDP* are both statistically significant ( $p\text{-Value}=0.0000 \leq 1\%$ ) at all levels of significance;
- Having minded the *ceteris paribus* principle:
  - The increase of *INFLRATE* by 1 percentage points [pp] will decrease *GLOANS2GDP* by 0.140283 [pp] (statistically not significant impact,  $p\text{-Value} = 0.6686 > 10\%$ );
  - The increase of *INTRATE* by 1 [pp] yields an increase of *GLOANS2GDP* by 2.137237 [pp] (statistically significant impact,  $p\text{-Value} = 0.0000 < 5\%$ );
  - The increase of *GDP* by 1 million [MKD] is expected to increase *GLOANS2GDP* by 0.000222 [pp] (statistically significant impact,  $p\text{-Value} = 0.0000 < 5\%$ ).

## 5. CONCLUSION

This paper investigates the impact of several key determinants on corporate debt in North Macedonia from 2015:Q1 to 2023:Q3. Specifically, it focuses on the Gross Loans to Non-Financial Sector/GDP ratio as a proxy for corporate debt and examines its relationship with the Inflation Rate, Interest Rate of Non-Financial Sector Loans, and GDP. The empirical analysis employs the Auto-Regressive Distributed Lag (ARDL) method for time series analysis using the EViews v10 econometric package. The study findings, which are entirely in line with actual economic situation in North Macedonia, reveal that the Inflation Rate (*INFLRATE*) has a negative long-term effect on the Gross Loans to Non-Financial Sector/GDP ratio (*GLOANS2GDP*), and both the first and second lags exhibit negative impacts in the short-run. However, the third lag positively influences the current value of the target variable, albeit with statistically significant impact at a 10% level of significance. These outcomes are attributed to the high variability observed in the independent variable *INFLRATE*. Conversely, the Interest Rate of Non-Financial Sector Loans (*INTRATE*) and the Gross Domestic Product (*GDP*) demonstrate positive and statistically significant relationships with *GLOANS2GDP* in the long-run. Global challenges such as the energy crisis and high inflation rates have adversely affected economic growth. Specifically, in 2022, real GDP experienced a growth rate of 2.10%, marking a decline from the 3.90% growth observed in 2021. However, due to government interventions in 2022 and the implementation of restrictive monetary and credit policies in the Republic of North Macedonia, growth in gross domestic product has been observed in the second and third quarters of 2023. The high inflation rate escalates business operation costs and amplifies uncertainty and risk premiums, thereby exerting a negative impact on gross investments. From the second quarter of 2022 onwards, Macedonian companies encountered a significant surge in the inflation rate, reaching its pinnacle in the fourth quarter of 2022 at 19.40%. In an effort to mitigate inflationary pressure and expectations, the National Bank of Republic of North Macedonia initiated a gradual rise in the base interest rate, climbing from 3.67% in the second quarter of 2021 to 5.36% in the third quarter of 2023. Despite this interest rate hike, corporate sector indebtedness persists at a high level, affirming the dominance of bank loans as the primary financing source for Macedonian businesses. Future research will focus on exploring the influence of additional macroeconomic indicators, such as gross investments to GDP ratio, on the indebtedness levels within the corporate sector. This investigation will aim to broaden our understanding of the factors affecting corporate financial behavior and risk management strategies.

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### **Viktorija Petrov**

Faculty of Economics,  
 University of Novi Sad  
 Novi Sad, Serbia

viktorija.petrov@ef.uns.ac.rs

### **Zoran Drašković**

Faculty of Technical Sciences,  
 University of Novi Sad  
 Novi Sad, Serbia

zoran.draskovic@uns.ac.rs

### **Dorđe Čelić**

Faculty of Technical Sciences,  
 University of Novi Sad  
 Novi Sad, Serbia

celic@uns.ac.rs

## **ASSESSING COLLABORATIVE CLIMATE IN ORGANIZATIONS**

**Abstract:** Collaborative climate is one of crucial aspects of knowledge-based economy and influences organizational success greatly. The aim of the research was assessment of reliability and validity of the Collaborative Climate Assessment (CCA) instrument that contains 20 items measuring four constructs: Organizational Culture, Immediate Supervisor, Employee Attitude and Work Group Support. The instrument was tested on the sample of 283 respondents from organizations in Serbia. The unidimensionality of each subscale of the instrument was established along with the research results proving reliability and validity of the modified CCA instrument.

**Keywords:** Collaborative Climate, Organizational Culture, Knowledge Economy

### **1. INTRODUCTION**

The literature on knowledge-based economy (KBE) and knowledge management (KM) constantly reinforces the notion that a collaborative climate is crucial for the effective performance of the organization. To survive in the global knowledge-based economy, all organizations must address their KM issues in order to keep up with the speed and dynamics of the modern marketplaces (Alee, 2008). They can improve products, services and processes by exploiting their intellectual capital using the full potential of the exchange of tangible and intangible resources (Nonaka & Takeuchi, 1995). It is possible to achieve that only by exploiting dynamic value networks of knowledge-intensive relationships, inside and outside of their enterprise borders (Levy & Powell, 2005).

The concept of collaboration and collaborative climate are crucial aspects of a knowledge-based economy, and they play a vital role in fostering teamwork, knowledge sharing, and collective problem-solving (Sveiby, 2007). They impact organizational effectiveness and are key factors of business strategies for organizations operating in the knowledge economy (Edvission, 2000). A collaborative climate is a work environment that prioritizes open communication, shared goals, and mutual support among employees. It involves a culture of cooperation, trust, and inclusiveness, where individuals are encouraged to freely share their ideas and perspectives (Sveiby, 2007).

Studies suggest that a collaborative climate has a strong correlation with organizational effectiveness, particularly in knowledge-intensive fields (Drašković, 2019). A collaborative environment fosters creativity and innovation and leads to better decision-making due to the collective exchange of ideas and perspectives. Collaboration offers numerous benefits to organizations, including increased productivity, better problem-solving, improved decision-making, and enhanced employee engagement. Moreover, a collaborative climate creates a sense of belonging and fosters a positive work culture. Leadership plays a crucial role in setting the tone for a collaborative environment. Managers must lead by example, demonstrate the desired behaviour, and encourage others to do the same. Communication is also a key element of collaboration, and open and transparent communication channels are essential for information flow, knowledge sharing, and fostering trust among team members. Effective communication also involves active listening and responding to others' opinions and concerns.

A collaborative climate should create an environment that will enable employees to feel comfortable sharing their ideas and expressing their concerns without fear of judgment or repercussions. Trust is the foundation of any collaboration, thus organizations must create a safe space for employees to express themselves freely (Sveiby, 2007). Sveiby and

Simons 2002 emphasize that for knowledge sharing it is of special interest only one specific aspect of an organizational culture, called collaborative climate, which is described as the ‘permeability’ of the human infrastructure for knowledge sharing, and it can be seen as the shared mental space where knowledge sharing and creation take place.

Karl-Erik Sveiby is known for his work in knowledge management and organizational development. Some of the instruments and approaches for assessing collaborative climate aspects were developed in Sveiby’s work: Knowledge Mapping, Social Network Analysis (SNA), Knowledge Sharing Survey’s, Communities of Practice (CoPs), Knowledge Management Audits, and so on. His ideas and frameworks are adopted for developing an instrument for assessing collaborative climate. This instrument, known as Collaborative Climate Assessment (CCA), was developed by Sveiby and Simons 2002. In this paper, we focus on that specific CCA instrument for assessing collaborative climate in an organization, and we test if it is possible to apply it in a transitional economy environment. In other words, we test the validity of the instrument for assessing the collaborative climate in organizations in the Republic of Serbia.

## **2. THE INSTRUMENT FOR ASSESSING COLLABORATIVE CLIMATE IN ORGANIZATIONS**

A structured questionnaire was used in the process of creating an instrument for measuring the attitudes of employees in relation to the collaborative climate in the organization. All constructs and their related items used in the questionnaire were taken from published studies and linguistically adapted (Sveiby KE & Simons, 2002). The instrument called Collaborative Climate Assessment (CCA) contains 20 items that measure four constructs: Organizational Culture, Immediate Supervisor, Employee Attitude and Work Group Support each defined by 5 items. In the survey all of the items are measured on five-point Likert-type scales. The scales are anchored by (1) strongly disagree, (2) disagree, with (3) neutral (either agree or disagree) as the midpoint, (4) agree, and (5) strongly agree.

Organizational culture encompasses the shared values, beliefs, norms, and behaviours that characterize an organization. It shapes the way employees interact, make decisions, and approach their work. Assessing organizational culture involves examining the extent to which collaboration and knowledge sharing are embedded within the organization's cultural fabric. This includes evaluating cultural norms related to openness, trust, teamwork, and learning. Organizations with a collaborative culture typically exhibit characteristics such as transparency, inclusivity, and a collective focus on achieving common goals.

The immediate supervisor or manager plays a crucial role in shaping the day-to-day work environment and employee experiences. Through their leadership style and behaviours, supervisors influence employee motivation, engagement, and job satisfaction. Assessing the role of immediate supervisors involves evaluating their leadership practices, communication skills, and support for collaboration. This includes examining supervisors' ability to provide clear direction, facilitate teamwork, and empower employees to share knowledge and contribute ideas. Positive supervisor-employee relationships characterized by trust, respect, and mentorship are indicative of a supportive collaborative climate.

Employee attitude refers to individuals' beliefs, perceptions, and emotions toward their work, colleagues, and organizational environment. Attitudes influence employee motivation, behaviour, and willingness to engage in collaborative activities. Assessing employee attitudes involves measuring their perceptions of collaboration, knowledge sharing, and teamwork within the organization. This can be done through surveys or interviews to gauge employees' levels of engagement, satisfaction, and commitment to collaborative efforts. Positive attitudes toward collaboration are characterized by a sense of ownership, enthusiasm, and willingness to collaborate with others to achieve shared goals.

Workgroup support refers to the assistance, encouragement, and resources available to employees within their immediate work teams or groups. It encompasses the collective efforts of team members to support one another and achieve common objectives. Assessing workgroup support involves evaluating the level of cohesion, cooperation, and mutual assistance among team members. This includes examining team dynamics, communication patterns, and the extent to which team members collaborate effectively to solve problems and share knowledge. High levels of workgroup support are characterized by a sense of camaraderie, shared responsibility, and willingness to help each other succeed.

By incorporating these dimensions into a collaborative climate assessment instrument, organizations can gain a comprehensive understanding of the factors influencing collaboration and knowledge sharing within their workplace. This can lead to targeted interventions and initiatives aimed at fostering a more supportive and collaborative organizational culture.

### 3. THE RESULTS OF EVALUATING THE VALIDITY AND RELIABILITY OF THE INSTRUMENT FOR ASSESSING THE COLLABORATIVE CLIMATE IN ORGANIZATIONS

As the Collaborative Climate Assessment Instrument contains 20 items evaluating attitudes towards collaboration in the organization, a hypothesis was tested:

*H<sub>0</sub>: It is possible to identify and measure the attitudes of respondents from the Republic of Serbia regarding Collaborative Climate using the Collaborative Climate Assessment Instrument.*

The sample on which the analysis is performed consists of 282 respondents. In the sample, male respondents make up 46.4%, while female respondents make up 53.6%. The predominant age group in the sample is “older than 40”, which makes up 36.7% of the total sample. In terms of education, respondents with “completed high school or higher” are the most numerous and are represented with 51.6%, while the group of respondents with a “master's or bachelor's degree” is represented with 46.6%. The least represented group of respondents is “with doctorates”, as has been expected, with 1.8% of the entire sample.

The psychometric characteristics of the instruments were evaluated by applying Principal Component Analysis (CPA). The analyses were conducted at the individual level.

The aim of the research in this paper was assessing reliability and the validity of the CCA instrument. Initially, the unidimensionality of each subscale of instrument Collaborative Climate Assessment is tested. For this purpose, one-component factor analysis was applied to the items of each of the subscales. Using the criterion that the eigenvalues of the components were greater than 1 and the “Scree plot” criterion, one factor was extracted for each of the subscales. This confirmed that the subscales were unidimensional. In order to determine the reliability of the instrument, an analysis was performed on the entire sample. The results of the analysis for the defined dimensions showed high values, which was in accordance with previous research presented in the literature.

#### 3.1. The validity of subscale Organizational Culture

The measure of representativeness of the sample was assessed by the *Kaiser–Meyer–Olkin* (KMO) test. According to Kaiser's interpretation, the result of 0.762 indicated adequate sampling. Cronbach's alpha, as a measure of internal consistency, was used to assess the reliability of the subscale. The result of 0,778 (Table 5) proved the items were sufficiently consistent to indicate the measure was reliable. The significance of correlations between variables was measured by Bartlett's test of sphericity, which reached statistical significance ( $\chi^2= 420.056$ ;  $df=10$ ;  $p=0,000$ ). This fulfils the conditions that demonstrate the justification of the application of factor analysis.

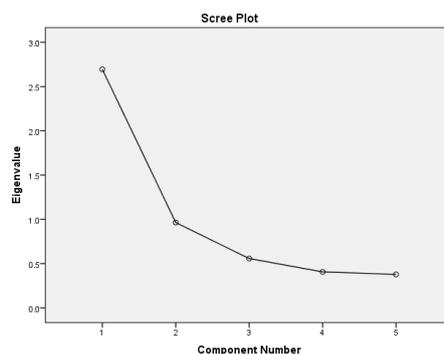
**Table 1:** Values of component saturations for the first principal component determined by the items of the subscale Organizational Culture

Organizational culture	Factor loadings
We are continuously encouraged to bring new knowledge into the Department	.798
Sharing of knowledge is encouraged by the Department in action and not only in words	.778
Open communication is characteristic of the Department as a whole	.775
We are encouraged to say what we think even if it means disagreeing with people we report to	.771
The people I report to keep me informed	.507

Source: autors, 2024.

The correlation between the factor and the item “The people I report to keep me informed” was found to be moderate (Table 1). However, it was included in the construct because of the adequate average variance extracted (AVE above 50%).

The subscale Organizational Culture can be considered one-dimensional, i.e. to have one measurement subject and to be homogeneous. The conclusion is made based on the amount of explained variance of the first principal component of 53.889%, whose characteristic root is  $\lambda=2.694$  (Table 5 and Scree Plot at Picture 1). The Organizational Culture construct is psychometrically valid and reliable because all variables have statistically significant factor saturation (Table 1).



**Picture 1:** Scree Plot of the components on the items of the Organizational Culture subscale  
**Source:** authors, 2024

### 3.2. The validity of subscale Immediate Supervisor

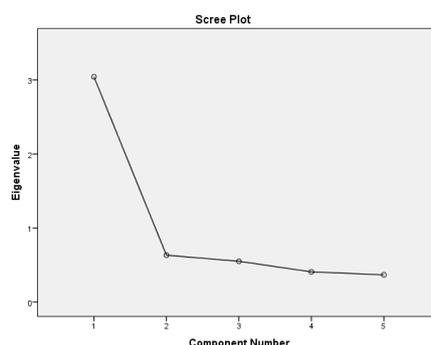
The measure of representativeness of the sample was assessed by the *Kaiser–Meyer–Olkin* (KMO) test. According to Kaiser's interpretation, the result of 0.843 indicated adequate sampling. Cronbach's alpha, as a measure of internal consistency, was used to assess the reliability of the subscale. The result of 0,837 (Table 5) proved the items were sufficiently consistent to indicate the measure was reliable. The significance of correlations between variables was measured by Bartlett's test of sphericity, which reached statistical significance ( $\chi^2= 515.111$ ;  $df=10$ ;  $p=0,000$ ). This fulfils the conditions that demonstrate the justification of the application of factor analysis.

**Table 2:** Values of component saturations for the first principal component determined by the items of the subscale Immediate Supervisor

Immediate Supervisor	Factor loadings
Encourages open communication in my working group	.837
Encourages – by action and not only words – sharing of knowledge	.811
Encourages me to come up with innovative solutions to work-related problems	.781
Keeps me informed	.756
Organizes regular meetings to share information	.709

**Source:** autors, 2024.

The subscale Immediate Supervisor can be considered one-dimensional, i.e. to have one measurement subject and to be homogeneous. The conclusion is made based on the amount of explained variance of the first principal component of 60.859%, whose characteristic root is  $\lambda=3.043$  (Table 5 and Scree Plot at Picture 2). The Immediate Supervisor construct is psychometrically valid and reliable because all variables have statistically significant factor saturation (Table 2).



**Picture 2:** Scree Plot of the components on the items of the Immediate Supervisor subscale  
**Source:** autors, 2024

### 3.3. The validity of subscale Employee Attitude

The measure of representativeness of the sample was assessed by the *Kaiser–Meyer–Olkin* (KMO) test. According to Kaiser's interpretation, the result of 0.849 indicated adequate sampling. Cronbach's alpha, as a measure of internal consistency, was used to assess the reliability of the subscale. The result of 0,865 (Table 5) proved the items were sufficiently consistent to indicate the measure was reliable. The significance of correlations between variables was

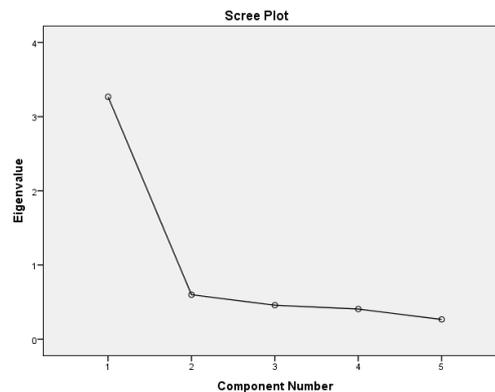
measured by Bartlett’s test of sphericity, which reached statistical significance ( $\chi^2= 650.278$ ;  $df=10$ ;  $p=0,000$ ). This fulfils the conditions that demonstrate the justification of the application of factor analysis.

**Table 3:** Values of component saturations for the first principal component determined by the items of the subscale Employee Attitude

Employee attitude	Factor Loadings
In the Department, information sharing has increased my knowledge	.876
I learn a lot from other staff in this Department	.830
Sharing information translates to deeper knowledge in this Department	.798
Most of my expertise has developed as a result of working together with colleagues in this Department	.775
Combining the knowledge amongst staff has resulted in many new ideas and solutions for the Department	.758

Source: autors, 2024.

The subscale Immediate Supervisor can be considered one-dimensional, i.e. to have one measurement subject and to be homogeneous. The conclusion is made based on the amount of explained variance of the first principal component of 65.356%, whose characteristic root is  $\lambda=3.268$  (Table 5 and Scree Plot at Picture 3). The Employee Attitude construct is psychometrically valid and reliable because all variables have statistically significant factor saturation (Table 3).



**Picture 3:** Scree Plot of the components on the items of the Employee Attitude subscale  
Source: autors, 2024

### 3.4. The validity of subscale Work Group Support

The measure of representativeness of the sample was assessed by the *Kaiser–Meyer–Olkin* (KMO) test. According to Kaiser's interpretation, the result of 0.707 indicated adequate sampling. Cronbach's alpha, as a measure of internal consistency, was used to assess the reliability of the subscale. The result of 0,642 (Table 5) proved the items were sufficiently consistent to indicate the measure was reliable. The significance of correlations between variables was measured by Bartlett’s test of sphericity, which reached statistical significance ( $\chi^2= 237.671$ ;  $df=10$ ;  $p=0,000$ ). This fulfils the conditions that demonstrate the justification of the application of factor analysis.

**Table 4:** Values of component saturations for the first principal component determined by the items of the subscale Work Group Support

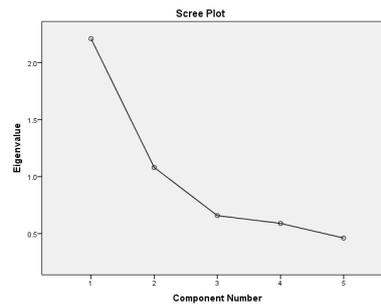
Work Group Support	Factor Loadings
We help each other to learn the skills we need	.786
There is much I could learn from my colleagues	.753
We keep all team members up to date with current events (e.g., news) and work trends	.697
We often share work experiences informally in our unit/section	.697
There are people here who prefer to work on their own	.234

Source: autors, 2024.

The correlation between the factor and the item “There are people here who prefer to work on their own” was not found, and the item was excluded from the Work Group Support subscale (Table 4).

The subscale Work Group Support can be considered one-dimensional, i.e. to have one measurement subject and to be homogeneous. The conclusion is made based on the amount of explained variance of the first principal component of

44.218%, whose characteristic root is  $\lambda=2.211$  (Table 5 and Scree Plot at Picture 4). The Work Group Support construct is psychometrically valid and reliable because four variables have statistically significant factor saturation (Table 4).



**Picture 4:** Scree Plot of the components on the items of the Work Group Support  
**Source:** authors, 2024

In this study, Cronbach’s coefficient alpha was used to calculate the internal consistency coefficients of the items included in the questionnaire. The overall reliability analysis results showed that the items in the four constructs had a satisfactory discriminating power of 0.917 (Table 5—Instrument CCA). The results indicated the satisfactory level of construct validity and internal consistency of this questionnaire. Furthermore, it was suitable for measuring the respondents’ conceptions of assessing the collaborative climate in the organizations.

**Table 5:** The reliability and variance extracted for the CCA instrument's subscales

Subscale	Cronbach's alpha	%	$\Lambda$
Organizational Culture	.778	53.889	2.694
Immediate Supervisor	.837	60.859	3.043
Employee Attitude	.865	65.356	3.268
Work Group Support	.642	44.218	2.211
Instrument CCA	.917		

\*  $\Lambda$  - the characteristic root of the first principal component; % - variance extracted

**Source:** authors, 2024.

## 4. CONCLUDING REMARKS

Collaboration and collaborative climate are crucial aspects of a knowledge-based economy. They play a vital role in fostering teamwork, knowledge sharing, and collective problem-solving. They impact organizational effectiveness and are key factors of business strategies for organizations operating in a knowledge economy. A collaborative climate is a work environment that prioritizes open communication, shared goals, and mutual support among employees. It involves a culture of cooperation, trust, and inclusiveness, where individuals are encouraged to freely share their ideas and perspectives.

A structured questionnaire was used to measure the attitudes of employees in relation to the collaborative climate in the organization. All constructs and related items used in the questionnaire were taken from published studies and linguistically adapted. The questionnaire called Collaborative Climate Assessment (CCA) contains 20 items that measure four constructs: Organizational Culture, Immediate Supervisor, Employee Attitude and Work Group Support, each defined by 5 items. It was tested on a sample of 282 respondents in Serbia.

The overall reliability analysis results showed that the items in the four constructs had a satisfactory discriminating power, indicating the satisfactory level of construct validity and internal consistency of this questionnaire. The hypothesis “*It is possible to identify and measure attitudes of respondents from the Republic of Serbia regarding Collaborative Climate using Collaborative Climate Assessment Instrument*” was confirmed. Alternatively, it was concluded that the CCA instrument is suitable to measure the respondents’ conceptions of assessing the collaborative climate in the organizations in the Republic of Serbia.

In conclusion, a collaborative climate is fundamental to successful organizations in today's dynamic business landscape. By fostering open communication, shared goals, and a supportive environment, businesses can unlock the collective potential of their workforce and achieve higher degree of innovation and efficiency. Organizations must recognize the importance of collaboration, invest in building a collaborative culture, and implement strategies to enhance it.

## ACKNOWLEDGEMENT

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**Jelena Trivić**

Faculty of Economics, University of Banja  
Luka  
Banja Luka, Republic of Srpska  
jelena.trivic@ef.unibl.org

**Marina Beljić**

Faculty of Economics in Subotica, University  
of Novi Sad  
Novi Sad, Serbia  
marina.beljic@ef.uns.ac.rs

**Olgica Glavaški**

Faculty of Economics in Subotica, University  
of Novi Sad  
Novi Sad, Serbia  
olgica.glavaski@ef.uns.ac.rs

## **SUSTAINABILITY OF CORPORATE TAX REVENUES IN EUROPEAN OECD ECONOMIES: EATR CUTS AND FDI INFLOW<sup>1</sup>**

**Abstract:** Base erosion and profit shifting (BEPS) is an endeavor to prevent increased profit shifting as a result of global tax competitiveness. However, there is still a scarcity of thorough analyses that quantify BEPS effects on the economy, tax revenues, employment, and welfare. This paper's main objective is to empirically evaluate the direct effect of EATR changes and indirect effect through FDI on the corporate tax revenue (CTR) in European OECD countries using available empirical data in the period 1998–2021. The paper analyses volume of capital/profit shifts which reflect tax revenues losses in some economies due to heterogenous tax policies within the EU. Using the (Pooled) Mean Group model a significant positive long-term relationship was confirmed between the CTR and the EATR; and between CTR and FDI. The Dynamic Common Correlated Effects (DCCE) model was implemented as a robustness check, and it confirms results revealed with PMG model in short-run. The findings show that on average in European OECD economies achieving tax competition leads to tax revenue loss. On the other hand, FDI increase creates positive effect on CTR. Furthermore, results show that completely different strategies exist in emerging vs developed European OECD economies – in terms of attracting FDI vs maintaining sustainable the level of tax revenues.

**Keywords:** EATR, corporate tax revenues, European OECD economies, PMG model, DCCE model.

### **1. INTRODUCTION**

Fighting corporate tax evasion and tax avoidance has long been a top priority for the governments of the European Union (EU) and the Organization for Economic Coordination and Development (OECD). Specifically, the activities of multinational corporations (MNCs) have raised concerns in recent years regarding their aggressive tax evasion approaches; profit-shifting results from MNCs utilizing different tax laws, loopholes, and inconsistencies across national tax systems. To date, individual governments have responded to the increasing tax revenue mobility across borders by lowering corporate tax rates in a downward spiral. Consequently, countries have been lowering their tax rates to zero with the aim to draw in foreign direct investment (FDI) and encourage GDP growth (Glavaški et al. 2022). Such tax strategies could jeopardize public finances, creating spillover effects by profit shifting and eroding tax bases in particular economies (Beljić et al. 2023). The effective average tax rate (EATR), which considers all tax incentives, is often used to achieve tax competition rather than the statutory tax rate. As a result, the OECD initiated an action against base erosion and profit shifting (BEPS) to achieve tax coordination among OECD, EU and G7 economies. 15% global minimum effective average tax rate on incomes is one of the key elements of the reform, which was ratified by more than 135 countries in October 2021. On the other hand, the level of EATR is important not only for FDI attraction, but also for determination of corporate tax revenues, which could be negatively affected by EATR lowering.

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Policymakers' interest in quantifying BEPS is growing, however there is still not enough of a thorough analysis that considers all the way that BEPS affects the economy, tax revenues, jobs, and welfare. Due to the complexity of the international tax system and the relationships it entails across all nations, evaluations should pay special attention to the various ways that corporate tax evasion, corporate investment, and total economic activity interact. Although BEPS is intended to mitigate the negative consequences of profit shifting caused by disparate tax regimes throughout the world, it may have unfavorable implications on some economies. The specific interest of this paper is to analyze the effects of BEPS implementation in European OECD economies, with a special emphasis on the tax strategies of both developed and emerging economies. More detailed, the question is in which economies decrease of EATR will directly diminish the corporate tax revenues, or the capital inflow will be enough to foster economic growth and maintain tax revenues sustainable.

This paper's main objective is to empirically evaluate the direct effect of EATR changes and indirect effect through FDI on the corporate tax revenue (CTR) in European OECD countries using available empirical data in the period 1998–2021. European OECD economies were selected since the OECD and EU are the main advocates of BEPS. The paper analyses volume of capital/profit shifts which reflect in tax revenues losses in some economies due to heterogeneous tax policies within EU. Although fiscal coordination exists in EU economies, de facto fiscal sovereignty leads to diversity in implementation of tax policies. The sample may thus be classified into two subgroups: developed European OECD economies and emerging European OECD economies<sup>2</sup>. These goals are analyzed in the framework of cross-sectional dependent, non-stationary, heterogeneous panels, using the (Pooled) Mean Group (PMG/MG) estimator to reveal the long-run relationship between the EATR, FDI and CTR, as well, heterogeneous error-correction parameters. Robustness check is implemented using Dynamic Common Correlated Effects estimator.

**Hypothesis 1 (H1):** *Long-run equilibrium relationship exists between effective average tax rates, foreign direct investments, and corporate tax revenues in the sample of 22 European OECD economies in the period 1998-2021.*

**Hypothesis 2 (H2):** *The speed of adjustment to the long-run relationship and key variables differs in groups of emerging/developed European OECD economies, i.e. different strategies for FDI attraction are used.*

The remainder of the paper is organized as follows. After the Introduction section, in Section 2 the empirical literature's current evidence is reviewed. Section 3 shows empirical evidence of EATR, FDI and CTR trends in analyzed period in European OECD economies. Section 4 discusses estimation results, while Section 5 is dedicated to robustness check. The last part of the paper outlines the concluding remarks.

## 2. LITERATURE REVIEW

The literature consulted in this paper addresses one of the primary effects of globalization—increasing capital mobility—which European policymakers have identified as an important issue. Matthews (2011) notes that countries cannot ignore the potential effects regarding how their tax rates compare to other economies' rates on investment in a globalized world faced with high levels of capital mobility. More specifically, economies must consider the effective average tax rates, which account for various aspects of the tax base as well as the likelihood and magnitude of aggressive tax planning (Bénassy-Quéré et al. 2005; Barrios et al. 2014;). Exbrayat (2016) noted that designing tax systems across the EU could be challenging due to two opposite factors. Namely, on the one side national governments in developed and more populous countries tend to set higher corporate tax rates due to higher real market potential, however, on the other side trade liberalization has resulted in significant tax interactions that have pushed down corporate tax rates (especially EATR) in European countries. That is in accordance with Thanh & Canh (2020) which suggest that developed countries have the ability to maintain or increase the corporate tax rate in order to improve corporate income tax revenue, while in emerging economies, capital accumulation decreases. Mardan and Stimmelmayer (2020) demonstrate that the capacity of multinational corporations to shift profits is a critical factor in determining a nation's optimal taxation. Their several findings correspond with the real trends in corporate income tax rate setting that have been observed throughout emerging and developing economies. The results explain the trends in corporate income tax rates across economies differing in levels of development (Milton 2017; Matthews 2011; Van Ganzen 2023). Furthermore, they demonstrate that countries' absolute risk level is determined by tax rate strategies due to costs of profit shifting.

An important aspect of this paper is implementation of proposed BEPS and its effects. The implementation of BEPS is a worthy goal for tax systems as it removes the pressures of tax competition. In the absence of tax competition, countries can compete based on economic fundamentals that are far too frequently ignored, such as investments in public infrastructure, research and development, and human capital formation (Clausing, 2021). According to Tørslov et al. (2020), if every nation had a uniform effective corporation tax rate, global revenues and investment would remain unchanged, but corporate profits would shift in location. In the high-tax nations of the European Union, profits would rise

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<sup>2</sup> Analyzed European OECD economies are categorized in two groups: 1) developed economies: Austria, Belgium, Denmark, Finland, France, Germany, Greece, Ireland, Italy, Luxembourg, Netherlands, Portugal, Spain, Sweden; 2) emerging economies: Czech, Estonia, Latvia, Lithuania, Hungary, Poland, Slovenia, Slovakia.

by around 15%, in the US, by 10%, and in today's tax havens, by 60%. Van de Vijver et al. (2020) emphasize that active tax planning has become a sustainability issue, since governments must deal with lower tax revenue, which is critical for achieving sustainable development goals. However, the authors demonstrated that OECD and EU authorities' measures against aggressive tax planning, such as the Action Plan against BEPS, are ineffective, hence aggressive tax planning remains widespread. Furthermore, Cantos (2022) notes that neither the successful implementation of a minimum tax rate of 15% in corporate tax nor a considerable reduction in the advantages transmitted to tax havens are anticipated. Riccardi (2021) acknowledges the necessity for a coordinated tax response, but she argues that in building this solution, attention should be paid to distinctive traits and policy preferences demonstrated by emerging economies.

Given that there are conflicting opinions in the literature and that there is a lack of scientific research that would confirm the effects of BEPS implementation in developed versus emerging economies, the authors of the paper considered this research a necessary contribution to the existing literature. Gropp and Kostial (2001) shows that tax harmonization as policy for elimination of harmful tax effects could have different effects on high-tax economies in comparison to low-tax economies. Namely, high-tax nations would gain from harmonization while low-tax countries would lose revenues in response to changes in FDI flows. Furthermore, Álvarez-Martínez et al. (2022) demonstrate that a more thorough evaluation of the scope of BEPS and its effects on tax revenues and the overall economy is thus necessary. Their thorough country-by-country analysis also demonstrates that profit shifting may benefit or negatively impact nations. In general, BEPS mostly affects nations with high corporate income tax rates and substantial FDI stocks. When the global minimum tax rate is high enough to stop profit shifting, the welfare effect is unquestionably positive. However, the analysis indicates the risk of introducing a global minimum tax at a low rate since profit shifting persists and havens maintain part of the global revenue gain due to the policy (Johannesen, 2022). Mosquera Valderrama et al. (2018) highlighted source/residence that bias in the prevalent OECD models and power imbalances in double tax treaties are two significant tax issues that emerging economies face, and they are not addressed by the existing BEPS framework. Thus, most emerging economies face a trade-off: maintaining public revenue level or attracting foreign direct investment and economic growth.

### 3. TREND IN EATR, CTR, AND FDI

The race to the bottom trend of effective average tax rate is unquestionable worldwide. Cutting taxes is the result of the fact that a competitive EATR was recognized as a stimulator for FDI inflow. OECD economies, especially European economies reduced EATR on average 9% (from average value of EATR 28.8% to 19.8%, Figure 1). Achieved average value is far away from defined level of global minimum rate of EATR (15 %), since developed economies decreased EATR only to 22.8% in average in 2021. However, if the analysis is based only on emerging European OECD economies, the situation is different since the average value is almost 15%. EATR was decreased in emerging economies from average value 25.43% in 1998 to 15.06% in 2021, while some emerging economies proposed EATR on the even lower level (Estonia: 10.2% in 2021, Hungary: 11.1% in 2021, Lithuania 12.7% in 2021). Since that those economies have broken the bottom value of 15%, the question is how the introduction of global minimum tax rate as obligatory rule would affect those economies, and generally how declining trend of EATR affect sustainability of corporate tax revenues. According to Figure 1, the trend of EATR decline corresponds to corporate tax revenues decline (from average value 7.77% to 6.51% of GDP in 2020). More detailed, in the group of emerging economies CTR declined from 6.48% in 1998 to 5.69% in 2020, and in group of developed economies from 8.7% to 7.7% of GDP.

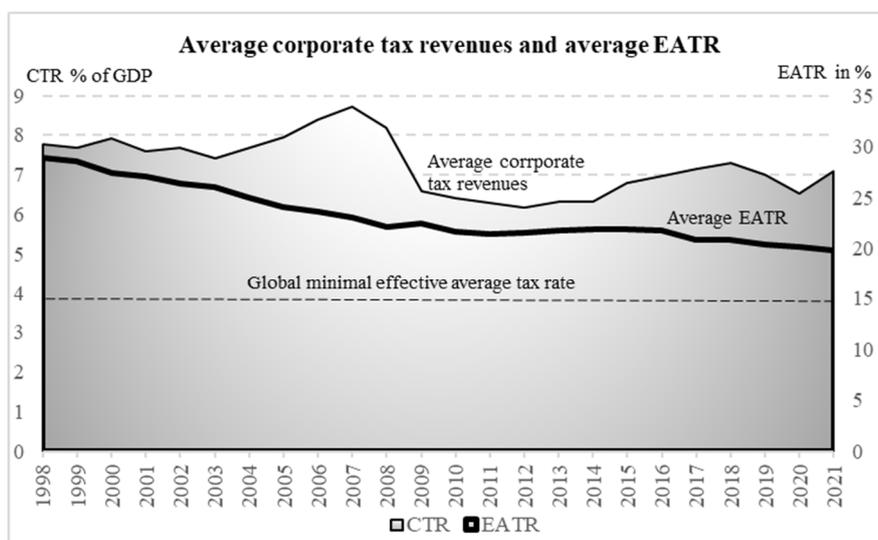
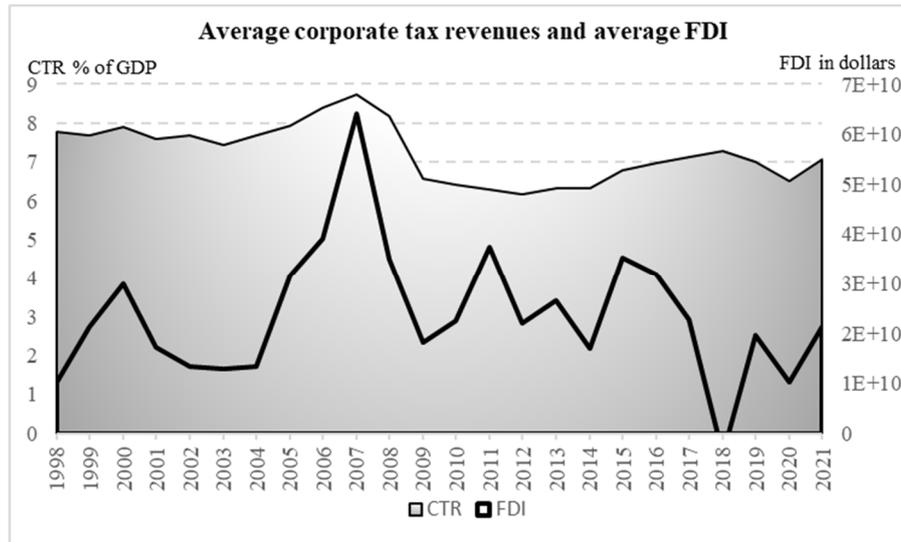


Figure 1: Average CTR, average ETAR and global minimum rate of EATR in European OECD economies  
Source: Authors.

According to the former analyses it seems that emerging European OECD economies strategy is providing FDI inflow via EATR reduction, namely, trying to affect FDI indirectly. On the other hand, developed European OECD economies use this strategy less, since those economies are oriented towards direct influence on FDI, providing other type of investments: investments in public infrastructure, research and development, human capital formation. Therefore, fluctuation of FDI in European OECD economies is huge during the analyzed period, taking into consideration the period of economic boom and recessions, as well as heterogeneous sample (Figure 2). Namely, higher levels of FDI are mostly oriented toward developed economies, however, in 2004-2006, just after joining the EU, FDI was very oriented in a higher level in emerging economies. Different strategies in attraction of FDI result in diverse effect on corporate tax revenue sustainability, indicating that a more subtle econometric analysis is needed.



**Figure 2:** Average CTR and average FDI in European OECD economies  
**Source:** Authors.

#### 4. EMPIRICAL RESULTS AND DISCUSSION

The analysis is based on a panel data econometric framework, which allows the investigation of the long-run relationship between CTR, EATR, and FDI in European OECD economies (Hypotheses (H1)). Considering the sample analyzed, the longest possible period 1998–2021 (T=23), due to the availability of data related to the EATR, for the 22 European OECD economies (N=22), firstly, cross-sectional dependence (CSD) in the panel is tested. The results of the Pesaran CD test are presented in Table 1 (panel a) and simultaneously represent analysis related to Hypothesis (H1) (for CTR, EATR, and FDI) implying that the null hypothesis of cross-section independency must be rejected for the variables EATR, CTR and FDI (Table 1, panel (a)).

**Table 1:** Pesaran CD test, Pesaran CIPS test and Westerlund cointegration test

Variables	Pesaran CD Test (a)	p-val.	Lag	Pesaran (CIPS) test in the level (b)	p-values	Pesaran (CIPS) test - first differences (b)	p-values	Westerlund Cointegration Test (c)	p-values	
<b>Sample: 22 European OECD economies; period 1998-2021</b>										
<b>CTR</b>	13.95	0.000	0	-1.266	0.103	-17.097	0.000	Pt	-7.256	0.000
			1	-0.363	0.358	-9.226	0.000			
			2	0.693	0.756	-6.492	0.000			
<b>EATR</b>	37.97	0.000	0	-0.476	0.317	-14.893	0.000	Pa	-4.067	0.007
			1	-1.772	0.038	-5.461	0.000			
			2	-1.434	0.076	-4.181	0.000			
<b>FDI</b>	12.43	0.000	0	-7.302	0.000	-20.515	0.000	Pa	-4.067	0.007
			1	-1.479	0.070	-15.785	0.000			
			2	1.723	0.958	-5.533	0.000			

**Source:** Authors based on Stata 15.

Due to the CSD test results, the Pesaran CIPS test (2007), a second-generation panel unit root test, is utilized, allowing CSD. Unit root tests do not reject the null hypothesis of non-stationarity, which means that the variables CTR and EATR are non-stationary, as well as the variable FDI. After that, the stationarity of the first differences was tested, and the results show that all variables are stationary (Table 1, panel (b)). Due to the existence of CSD, a robust version of Westerlund's test is used to test cointegration between variables CTR, EATR and FDI. According to the Westerlund test results the alternative hypothesis of cointegration is accepted for both models (Pt and Pa), and the null hypothesis of no cointegration is rejected (Table 1, panel (c)).

**Table 2:** PMG and MG estimator results for European OECD economies in the period 1998-2021 (homogeneous coefficients)

<b>Sample: 22 European OECD economies; period 1998-2021</b>					
<b>Dependent variable: CTR</b>		<b>Long-Run Equilibrium (<math>\theta</math>)</b>		<b>Error-Correction (<math>\phi_i</math>)</b>	
		<b>Coef.</b>	<b>p-value</b>	<b>Coef.</b>	<b>p-value</b>
<b>MG</b>	<b>EATR</b>	0.0831	0.370	-0.9920	0.000
	<b>FDI</b>	4.72	0.131		
<b>PMG</b>	<b>EATR</b>	0.1062	<b>0.001</b>	-0.978	0.000
	<b>FDI</b>	4.90	<b>0.000</b>		
<b>Hausman test statistic</b>		<b>0.8126</b>		<b>0.000</b>	

**Source:** Authors based on Stata 15.

Homogeneous coefficients in the model estimated by PMG and MG are shown in Table 2. In the case of PMG, the long-run relationship between CTR, EATR, and FDI is estimated, while error-correction vector is significant, negative and between 0 and 1, confirming cointegration relationship. Positive significant relationship is expected since changes in state tax bases influence tax revenues. Namely, governments wishing to increase FDI by using tax credits or generous depreciation allowances to encourage investment, could result in significant corporate tax revenue decline (Suárez Serrato and Zidar, 2018). Thus, long-run cointegration relationship is significant, EATR cuts lead to CTR decreasing, as well as FDI decrease causes CTR drops, while EATR cuts affects FDI inflow. Therefore, it could be concluded that reduction in the EATR leads to a decrease in CTR inflows, while reduction of FDI leads to a decrease in CRT inflows, and vice versa. Error-correction coefficients show fiscal adjustment - about 97.8 % of deviations from long-run equilibrium relationship are corrected in one year according to PMG method, in case of MG method 99.2 % of deviations are corrected. However, using the Hausman test, the PMG model was revealed to be more efficient, and thus the dynamics of the heterogeneous adjustment coefficient was analyzed using the PMG model. Therefore, heterogeneous adjustments coefficients will be analyzed using PMG estimator with heterogeneous coefficients (Table 3).

**Table 3:** PMG estimator results for European OECD economies in the period 1998-2021 (heterogeneous coefficients)

<b>Sample: 22 European OECD economies; period 1998-2021</b>						
<b>Dependent variable: CTR</b>						
<b>PMG Estimator</b>	<b>Error-correction (<math>\phi_i</math>)</b>		<b><math>\Delta</math>EATR</b>		<b><math>\Delta</math>FDI</b>	
<b>Emerging European OECD economies</b>	<b>Coef.</b>	<b>p-value</b>	<b>Coef.</b>	<b>p-value</b>	<b>Coef.</b>	<b>p-value</b>
<b>Czech</b>	-0.7574	0.000	-0.013	0.889	<b>-3.53</b>	<b>0.018</b>
<b>Estonia</b>	-0.74180	0.000	-0.0494	0.682	<b>-6.00</b>	<b>0.002</b>
<b>Latvia</b>	<b>-0.9608</b>	<b>0.000</b>	<b>0.0846</b>	<b>0.027</b>	5.02	0.905
<b>Lithuania</b>	-0.6486	0.002	0.0314	0.648	-2.28	0.473
<b>Hungary</b>	-0.667	0.000	-0.0453	0.365	<b>-3.21</b>	<b>0.006</b>
<b>Poland</b>	-0.898	0.000	-0.0207	0.669	<b>-4.13</b>	<b>0.010</b>
<b>Slovenia</b>	<b>-0.9472</b>	<b>0.000</b>	<b>-0.0276</b>	<b>0.050</b>	-6.47	0.763
<b>Slovakia</b>	-0.8231	0.000	0.030	0.424	<b>-3.74</b>	<b>0.019</b>
<b>Developed European OECD economies</b>						
<b>Austria</b>	-1.310637	0.000	0.00377	0.996	<b>-6.38e</b>	<b>0.002</b>
<b>Belgium</b>	<b>-0.8554</b>	<b>0.000</b>	<b>0.00337</b>	<b>0.048</b>	<b>-4.17e</b>	<b>0.000</b>
<b>Denmark</b>	-1.247	0.000	0.1337	0.385	<b>-6.03</b>	<b>0.004</b>
<b>Finland</b>	-1.111	0.000	0.0195	0.839	<b>-5.08</b>	<b>0.007</b>
<b>France</b>	-1.245	0.000	-0.0424	0.312	<b>-5.98</b>	<b>0.003</b>

Germany	-1.098	0.000	0.0064	0.864	<b>-5.36</b>	<b>0.002</b>
Greece	-1.137	0.000	-0.1215	0.036	6.76	0.879
Ireland	<b>-0.801</b>	<b>0.000</b>	0.139	0.556	<b>-3.84</b>	<b>0.002</b>
Italy	-1.090	0.000	-0.0078	0.894	<b>-5.39</b>	<b>0.000</b>
Luxembourg	<b>-0.8317</b>	<b>0.000</b>	<b>0.2088</b>	<b>0.064</b>	<b>-4.09</b>	<b>0.002</b>
Netherlands	-1.085	0.000	-0.0259	0.084	<b>-5.31</b>	<b>0.004</b>
Portugal	-1.079	0.000	-0.1170	0.016	<b>-5.74</b>	<b>0.001</b>
Spain	-1.1578	0.000	-0.0177	0.793	<b>-5.51</b>	<b>0.005</b>
Sweden	-1.038	0.000	-0.0012	0.989	<b>-5.11</b>	<b>0.005</b>

Source: Authors based on Stata 15.

Heterogeneous panels' primary advantage is the estimates of each European OECD economy in the context of error-correction parameters. The correction of the equilibrium error (Table 3), which indicates adjustments towards long-term equilibrium is significant and negative in all emerging European OECD economies: Czech Republic, Estonia, Latvia, Lithuania, Hungary, Poland, Slovenia, Slovakia, while in developed European OECD economies: Austria, Belgium, Denmark, Finland, France, Germany, Greece, Ireland, Italy, Luxembourg, Netherlands, Portugal, Spain, Sweden, error-correction is significant but greater than 1, indicating overcorrection. Those completely different effects in emerging and developed European OECD economies indicate that predominantly emerging economies uses tax strategy of EATR reduction in order to attract FDI with expected negative results on CTR, while this strategy is not present in the group of developed economies. Reduction of EATR is not framework for tax strategy in developed economies to achieve FDI influx. Moreover, in the analyses of EATR and FDI effects on CTR, it could be noticed that EATR is not significant variable in developed economies (EATR is not significant variable in developed economies (except in Belgium, Greece, Luxemburg, and Portugal), while FDI effect is present in all developed economies (except Greece). The mentioned result indicates that developed European economies focus FDI directly, not via EATR reduction as emerging European OECD economies. Emerging European OECD economies combine reduction of EATR in order to increase FDI, since both variables are significant. Therefore, emerging economies are more exposed to risk in context of their budget sustainability. Specifically, heterogeneous coefficient of error-correction could be explained as follows:

- (a) In the group of emerging economies, the highest coefficients are present in Latvia and Slovenia, which indicates that in those emergent open economies there is a rapid adjustment towards equilibrium (96.8% and 94.7%, respectively). In the group of emerging economies, only in Latvia and Slovenia EATR influence is significant. Namely, analyzing the impact of reducing EATR on CTR in Latvia, it can be concluded that achieving tax competitiveness is at the expense of reducing CTR (Mosquera Valderrama et al. 2018), as it is indicated by the positive relationship between EATR (decrease in EATR from 22.7% to 16.7%) and CTR (decrease in CTR from 6.97% to 2.74%). However, the reduction of EATR in Slovenia enables the growth of CTR due to the negative relationship of the analyzed variables. Namely achievement of tax competitiveness (reduction of EATR from 20.9% to 17.3%), in Slovenia, ensures the CTR increases (growth of CTR from 2.58% to 5.17%).
- (b) In other emerging European OECD economies (Czech Republic, Estonia, Hungary, Poland, and Slovakia) focus is on FDI variable, instead on EATR, showing that direct effect between FDI and CTR is present.
- (c) In the group of developed economies, the highest coefficients are present in Belgium and Luxembourg (85.5% and 83.1%; respectively). The EATR reductions, in these economies, made the tax competitiveness increase (from 34.5% to 23.2% in Belgium; from 32.6% to 21.8% in Luxembourg), however, it put public revenues at risk and resulted in lower corporate income tax revenue (from 40.17% to 29.5% in Belgium; from 37.4% to 24.9% in Luxembourg). Thus, EATR reductions were not enough to stop the tax revenue spillover into the EU members with lower EATR rates (Johannesen, 2022).
- (d) Other developed economies do not use reduction of EATR as framework for their tax strategy since that those economies focus FDI directly.

Given the results presented it could be concluded that emerging economies are much more sensitive to tax base changes (EATR) in contest of tax revenue levels, since their strategy is predominantly oriented toward EATR reduction to increase FDI. Hence, EATR adjustments towards proposed BEPS minimum could jeopardize their tax revenue even more creating budget deficits. However, it is necessary to explore short-term and long-term relationship between CTR and EATR for clearer conclusion on EATR influence on CTR.

## 5. ROBUSTNESS CHECK

Due to some limitation of PMG method when cross-sectional dependence is present in the model, we checked robustness of estimates using different method. Namely, additional estimation was conducted by Ditzgen (2018) Dynamic common correlated effects (DCCE) method (Table 4) since that method includes cross-sectional dependence. In Table 4, the results of the tested model show that there is no cross-sectional dependence (Pesaran, 2021). Furthermore, homogeneous parameters are presented, in the short and long-run. According to homogeneous parameters, lagged value of dependent variable is significant, while EATR lowering has positive effects on CTR in the short run, and FDI influence positively on CTR, which is in accordance with the PMG estimation results. Moreover, in the long run the negative relationship between EATR and CTR was revealed by DCCE, which is confirmation of some heterogeneous results shown from PMG for certain European OECD economies. Influence of FDI influx on CTR is positive in long run, as well.

**Table 4.** DCCE estimator results for homogeneous coefficient for European OECD economies in the period 1998-2021

Sample: 22 European OECD economies; period 1998-2021					
Dependent variable: CTR					
Short-run			Long-run		
DCCE	Coef.	p-value	DCCE	Coef.	p-value
Lag_CTR	-0.732	0.080	EATR	<b>-4.296</b>	<b>0.035</b>
EATR	<b>0.453</b>	<b>0.042</b>	FDI	<b>3.40</b>	<b>0.028</b>
FDI	<b>2.65</b>	<b>0.041</b>	Adjustment term		
Lag_EATR	-0.296	0.062	LR_CTR	-1.732	0.000
Lag_FDI	-2.051	0.063			
CSD Pesaran Xie CD*	0.24	0.813			

Source: Authors based on Stata 15.

Conclusions related to robustness check using other method are: (1) the same variables – EATR and FDI, with the same sign, significantly determine CTR, as in case of previously applied PMG method in short-run, (2) while in long-run EATR has different (negative) sign showing that tax competition could be beneficial for some European OECD economies, which should be investigated in more detailed in future research.

## 6. CONCLUSION

Considering current unsustainable circumstances, European OECD economies face the enormous challenge of maintaining stable public revenue sustainable. On the one hand, for decades national governments opt for competing tax strategies in order to attract FDI. Race down to zero is a common strategy for emerging EU economies, particularly. EU economies. However, this tax approach could jeopardize tax revenues and consequently lead to gaining budget deficits and high public debt. Namely, due to the globalized world and common market within EU, capital is highly mobile, which ensures multinational corporations to shift their profit bases easily. This is an especially important issue in terms of geopolitical crisis across the world. As response to escalating problem, OECD in coordination with EU offered BEPS and proposed minimum global EATR. Thus, the main goal of BEPS is to stop or at least decrease tax revenue shifting within economies. The special interest of the paper was the examination of the long-term relationship when crisis years are included in the model. The special interest of the paper was the examination of the long-term relationship between CTR, EATR, and FDI. The paper's main findings are: (a) the results of dynamic panel models (PMG model) on a sample of 22 European OECD economies in the period from 1998-2021 confirm the existence of a long-term positive relationship between the CTR and the EATR; and between CTR and FDI. Namely, in the EU average, a reduction in the EATR leads to a decrease in CTR inflows by 1.09%. Therefore, the findings show that on average in European OECD economies achieving tax competition leads to tax revenue loss. On the other hand, FDI increase creates positive effect on CTR. (b) Completely different strategies exist in emerging vs developed European OECD economies - emerging economies uses tax strategy of EATR reduction in order to attract FDI with expected negative results on CTR, while this strategy is not present in the group of developed economies – those economies focus FDI directly, not through EATR reduction. (c) Emerging economies are much more sensitive to tax base changes (EATR) in context of tax revenue levels compared to developed European OECD economies. The highest speed of adjustment towards equilibrium is higher in emerging economies – Latvia and Slovenia (96.8% and 94.7%, respectively) than in Belgium and Luxembourg (85.5% and 83.1%; respectively). (d) In Latvia, positive relationship between CTR and EATR was revealed, meaning that EATR cuts leads to CTR decrease, however, as results showed, achieving tax competitiveness in Slovenia ensured gaining tax revenues on corporate profits. (e) Even though developed countries cut their EATR, the tax revenue spillover to tax competitive

economies is still present. (e) The Dynamic Common Correlated Effects model was implemented as a robustness check since that method includes cross-sectional dependence. The DCCE model confirmed the conclusions based on the PMG model in relation to the short-run relationship between CTR and EATR, and between EATR and FDI. To summarize, from the results shown policy makers are facing a tradeoff between tax competitiveness and sustainable tax revenues, since down to zero race could jeopardize tax revenue. However, in some European OECD economies (Slovenia), lowering EATR increased tax revenues, which could be explained by EATR low enough to attract profits the other EU economies. Namely, in order to stop profit shifting and eroding tax bases the global minimum tax rate is high, and the question is whether the proposed minimum is high enough.

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### **Aleksandr Chernykh**

PhD Student,  
 European University at St.Petersburg  
 Saint-Petersburg, Russia  
 achernykh@eu.spb.ru

## **EVENT-DRIVEN ANALYSIS OF THE EFFECTIVENESS OF EUROPEAN ECONOMIC SANCTIONS AGAINST RUSSIA (2022-2024)**

**Abstract:** This paper examines the effectiveness of European economic sanctions against Russia from 2022 to 2023, with a focus on the impact of these measures on the Russian oil & gas sector. Prior to the implementation of large-scale sanctions, the European Union was Russia's principal trading partner. Against this backdrop, this study assesses the impact of European restrictions on Russia. Utilizing the event analysis method, renowned for its reliability in assessing the effects of anti-Iranian sanctions and previous sanctions against Russia during 2014-2021, this research analyzes data from the oil & gas sector of the Russian stock market on the Moscow Exchange. Despite significant attention to oil exports from the sanctions imposers, findings indicate a minimal impact on the oil and gas sector. The study aims to shed light on the economic ramifications of these recent sanctions and seeks to contribute to the broader discourse on the efficacy of economic sanctions as a tool of foreign policy.

**Keywords:** economic sanctions, stock market, event studies, Russia

### **1. INTRODUCTION**

In the first half of 2022, economic sanctions of unprecedented scale and severity were imposed against Russia. Since these sanctions still have not achieved their declared objectives, the number of anti-Russian sanctions continues to rise. The existing sanctions have been intensified and extended, with the rare occurrence of sanctions against individuals being lifted. The diversity of sanctions, coupled with the persistence of anti-Russian economic policy despite the absence of clear results, inevitably sparks debate about the effectiveness of these sanctions (Egorov, 2023) and the chosen directions of restrictive measures.

It is essential to take into account that sanctions often fail to achieve their intended goals, yet they inflict economic harm on the target country (Hufbauer & Jung, 2021). Therefore, this paper aims to evaluate the effectiveness of sanctions, focusing on the expressive motives behind their imposition (Kaempfer & Lowenberg, 1988). Given the multitude of sanctions and the failure to attain their declared objectives, assessing their effectiveness through the economic damage they cause enables the identification of the most impactful sanctions, as well as the most susceptible targets of their influence.

Building upon prior research, it is argued that the case of Russia over the past two years has not only involved an unprecedented number of comprehensive sanctions but also a multitude of restrictions that have rendered traditional assessment methods impractical (see Chernykh, 2024, for more details). However, only a fraction of these numerous restrictions impacted the stock market (Press Service of the Central Bank of Russia, 2022), which still permits the use of various methods to assess the sanctions' impact on open trading data. One such method is the event study method, utilized in this paper. This approach enables the examination of how the imposition of large-scale, sectoral, or targeted sanctions affects the performance of listed Russian public companies.

## 2. METHOD OF RESEARCH

The Russian stock market, particularly the equity segment, experienced a significant shock in February-March 2022. The Moscow Exchange Index (IMOEX) fell by more than 1,500 points, losing about 40% of its capitalization since the beginning of February 2022 and reverting to its 2016 values. This decline may reflect investor sentiment on both realized and expected negative events related to the Russian economy. Given the multidimensional nature of significant events affecting Russian investors, it is important to distinguish between military and domestic political events and those specifically related to sanctions to understand the effectiveness of sanctions.

The event study method can provide tools for such a task. It is widely used in financial research to assess the impact of individual or sectoral shocks on stock prices. These shocks can include, for example, the publication of quarterly or annual reports by a company, changes in management staff, and technological accidents, among others. More recently, the event study method has also been applied to assess the impact of sanctions on public companies' stock prices, as seen in the cases of the Tehran Stock Exchange and anti-Iran sanctions (Ghasseminejad & Jahan-Parvar, 2021), the Moscow Stock Exchange and the 2014-2018 anti-Russian sanctions (Dovbnya, 2020), and the G7 sanctions on African companies (Obi et al., 2023).

In general terms, the event study method consists of considering the abnormal return of a stock during an event window. The abnormal stock return  $AR_t$  is calculated as the difference between the actual return  $r_t$  and the expected return  $E(r_t)$  according to equation (1):

$$AR_t = r_t - E(r_t) \quad (1)$$

The expected return is calculated according to the CAPM model using equation (2):

$$E(r_t) = \beta_0 + r_{ft} + \beta_{m,t-1}(r_{mt} - r_{ft}) + \varepsilon \quad (2)$$

Where  $r_{ft}$  is the risk-free return,  $r_{mt}$  is the market return,  $\beta_{m,t-1}$  is the market beta estimated in the previous period.

The cumulative abnormal return provides an indication of the accumulated anomaly during the event window and is calculated using equation (3):

$$CAR_{t+K} = \sum_{k=1}^K AR_{t+k} \quad (3)$$

The event window is a time interval equal to the same number of trading days before and after the analyzed event. The logic behind choosing the interval prior to the event for analysis is that before the announcement of sanctions, some group of insiders may potentially have information about the nature of future sanctions, which may be reflected in trading operations before the event.

Finally, the cumulative average abnormal return (CAAR) is the arithmetic mean of the CAR across all events for one particular sequential day of the event window of one particular security. Thus, the CAAR provides an opportunity to evaluate the firm-specific event study, i.e. to test whether there was a significant response to a typical event (typical sanctions) for a particular security.

The hypothesis of this paper is as follows: the imposition of significant sanctions against the Russian economy is expected to influence investors' decisions, leading to negative CAAR values for certain public companies. Identification of the company exhibiting the negative and maximum modulo CAAR value, according to the firm-specific event study, indicates its heightened susceptibility to such a typical event as the imposition or announcement of economic sanctions.

## 3. DATA

According to the statistics on Russia's foreign trade balance, in 2021, the European Union ranked first among Russia's trade partners, holding a share of more than 35% (Rosstat, 2022). Therefore, considering the potential difficulty in assessing the entire array of sanctions, this study aims to focus on the sanctions imposed by the EU as potential examples of the most significant sanctions.

According to Bergeijk & Dizaji (2022), the EU imposed five sanctions packages against Russia within six weeks, and the total number of targeted economic sanctions, excluding personal sanctions, reached 100 examples. Despite the attempts to evaluate this period (Sun et al., 2022; Yousaf et al., 2022), the limitations of using the event study method prevent the utilization of this turbulent sanctions period, as the method requires that the event windows do not overlap to avoid the confounding of the observed effects. Additionally, the first five weeks, coinciding with the initial sanctions packages, cannot be used due to the aforementioned lack of stock market trading.

This study utilizes the Peterson Institute for International Economics timeline of sanctions dataset (Bown, 2023) to select the sanctions events. The advantage of this dataset lies in the comprehensiveness of the sanctions cases. Specifically, the timeline includes not only the sanctions themselves in the time range from February 2022 to December 2023 but also their announcements. Given the research design, the announcement of the sanctions is also an important event for the study.

The list of sanctions includes both large-scale sanctions and reputational and image sanctions against individuals or industries representing an insignificant part of the Russian economy, such as sanctions against the luxury goods trade. Studies of the previous period of the anti-Russian sanctions from 2014-2021 indicate that the oil and gas industry was most vulnerable to sanctions pressure (Vladimirov, 2017; Zaytsev & Loshchenkova, 2023). Therefore, this study specifically focuses on Russian oil and gas stocks. It analyzes the companies included in the Oil & Gas Sectoral Index

of the Moscow Exchange (MOEXOG) as a representative sample of the relevant sector of the Russian economy (see Table 1 for details).

**Table 1:** The MOEXOG index structure

Ticker symbol	Company name	Weight, %
LKOH	PJSC Lukoil Oil Company	15.27
GAZP	Gazprom PJSC	14.87
NVTK	Novatek PJSC	14.83
ROSN	PJSC Rosneft Oil Company	14.64
TATN	PJSC Tatneft	12.32
SNGS	Surgutneftgas	7.67
SNGSP	Surgutneftgas (preferred shares)	7.66
TRNFP	Transneft JSC (preferred shares)	5.05
BANEP	Bashneft (preferred shares)	4.31
TATNP	PJSC Tatneft (preferred shares)	2.28
RNFT	Rusneft	1.09

Source: Moscow Exchange, 2024.

Having applied the following criteria to the sanctions list:

- Sanctions imposed by the European Union;
- Sanctions imposed after March 28, 2022;
- Sanctions targeted at the oil & Gas industry; and
- A minimum interval of seven days between the dates of sanctions;

a sample of sanctions presented in Table 2 has been obtained.

**Table 2:** The List of sanctions events declared by the EU against Russia's oil and gas industry

	Announcement date	Event description
(1)	30 May, 2022	6 <sup>th</sup> package: announcement of the oil import ban, and the SWIFT ban
(2)	03 June, 2022	6 <sup>th</sup> package: imposition of sanctions
(3)	02 September, 2022	8 <sup>th</sup> package: announcement of the oil price ceiling
(4)	06 October, 2022	8 <sup>th</sup> package: imposition of sanctions
(5)	05 December, 2022	8 <sup>th</sup> package: setting of a price ceiling for Russian crude oil of \$60
(6)	04 February, 2023	8 <sup>th</sup> package: setting of the price ceiling for Russian oil products
(7)	23 June, 2023	11 <sup>th</sup> package: ban on servicing Russian oil tankers in third countries
(8)	18 December, 2023	12 <sup>th</sup> package: enforcement of oil price cap

Source: Bown, 2023.

The daily yield obtained from the one year point on the zero-coupon government curve has been used as the risk-free rate  $r_{ft}$  in equation (2). The MOEX Russia Index return has been used as the market return  $r_{mt}$  in equation (2). The realized stock returns  $r_t$  are calculated as normal daily returns based on the closing prices in Russian rubles. All the listed financial variables have been taken from the CBonds information agency (CBonds, 2024). The market beta coefficients  $\beta_m$  from equation (2) have been calculated on a rolling basis based on 250 previous observations. All calculations have been made using the Python programming language, and the code used for the calculations is available in an open repository (Chernykh, 2024b).

## 4. RESULTS

Table 3 provides the CAAR calculations for all stocks in the MOEXOG index. The results are presented for the event window limited to 15 days, which enables the comparison of the results with other studies.

**Table 3:** CAAR for the oil and gas industry stocks, %

	BANEP	GAZP	LKOH	NVTK	RNFT	ROSN	SNGS	SNGSP	TATN	TATNP	TRNFP
-7	0,57	0,87	0,65	1,04	-0,63	0,39	0,56	1,45	1,02	0,61	1,70
-6	0,30	1,64	0,53	0,87	-0,52	0,02	1,11	1,43	1,67	1,35	1,65
-5	2,00	2,77	0,15	0,19	-0,38	-0,11	0,45	0,76	1,01	0,70	1,56
-4	0,61	2,58	-0,24	-0,28	-1,13	-0,40	0,76	1,36	0,44	0,71	1,36
-3	1,85	2,84	-0,36	-0,86	-1,37	0,50	0,75	2,37	1,24	0,83	1,74
-2	0,06	5,84	-0,91	-1,80	-2,29	-0,74	0,26	2,06	0,33	-0,23	1,04
-1	2,67	5,42	-0,23	-2,41	-0,90	-0,11	0,85	3,65	0,16	0,26	1,68
0	2,02	5,91	-1,12	-3,35	-0,06	-0,10	0,92	3,16	0,61	0,25	1,63
1	3,00	5,23	-1,23	-3,50	1,51	0,42	0,76	3,77	1,09	0,19	2,52
2	4,19	3,34	-0,59	-2,76	7,00	0,63	1,24	4,31	0,91	-0,15	3,41
3	4,34	3,48	-0,84	-3,43	5,04	1,04	1,39	4,86	0,88	0,28	4,05
4	4,36	3,80	-1,04	-3,75	5,24	1,76	1,33	4,94	1,33	0,23	4,80
5	4,28	3,67	-0,90	-4,40	4,72	2,07	1,72	5,40	2,35	0,71	5,63
6	4,89	3,76	-0,71	-4,21	5,27	2,09	1,25	4,67	2,97	1,29	4,53
7	4,32	3,51	-0,09	-4,18	4,06	2,22	0,70	4,10	2,96	1,67	4,20

Source: The author's calculation

It is noteworthy that out of eight securities in the oil and gas sector, only two (PJSC Lukoil Oil Company and Novatek PJSC) exhibited a final negative CAAR value. All other shares paradoxically showed positive final CAAR values, with four securities exceeding a 4% positive return.

These findings are in complete contrast to the results of previous studies. In Dovbnya's (2020) study, various portfolio compositions of Russian oil and gas stocks exhibited a final CAAR ranging from -4% to -7.5% in response to a typical sanctions announcement during 2014-2018. Similarly, Iranian equities displayed a CAAR between -1.5% and -5.4% in response to sanctions within a similar event window (Ghasseminejad et al., 2021). Returning back to the study of the 2022 case, Ahmed et al. (2022) find a similar response on the first day of the seven-day event window for nearly 600 European stocks that generate positive AR. There are also estimates of positive AR on the first day after the event for a wider sample of stocks (Mishara et al., 2024).

The situation remains unchanged when the event window width is reduced to seven or eleven days. The descriptive statistics are presented in Table 4, which demonstrates that altering the event window does not affect the final result. The average CAAR for all stocks in the sample remains positive, with Novatek PJSC showing the lowest values. The last row of Table 4 displays the CAAR values for the overall MOEXOG oil and gas index for comparison.

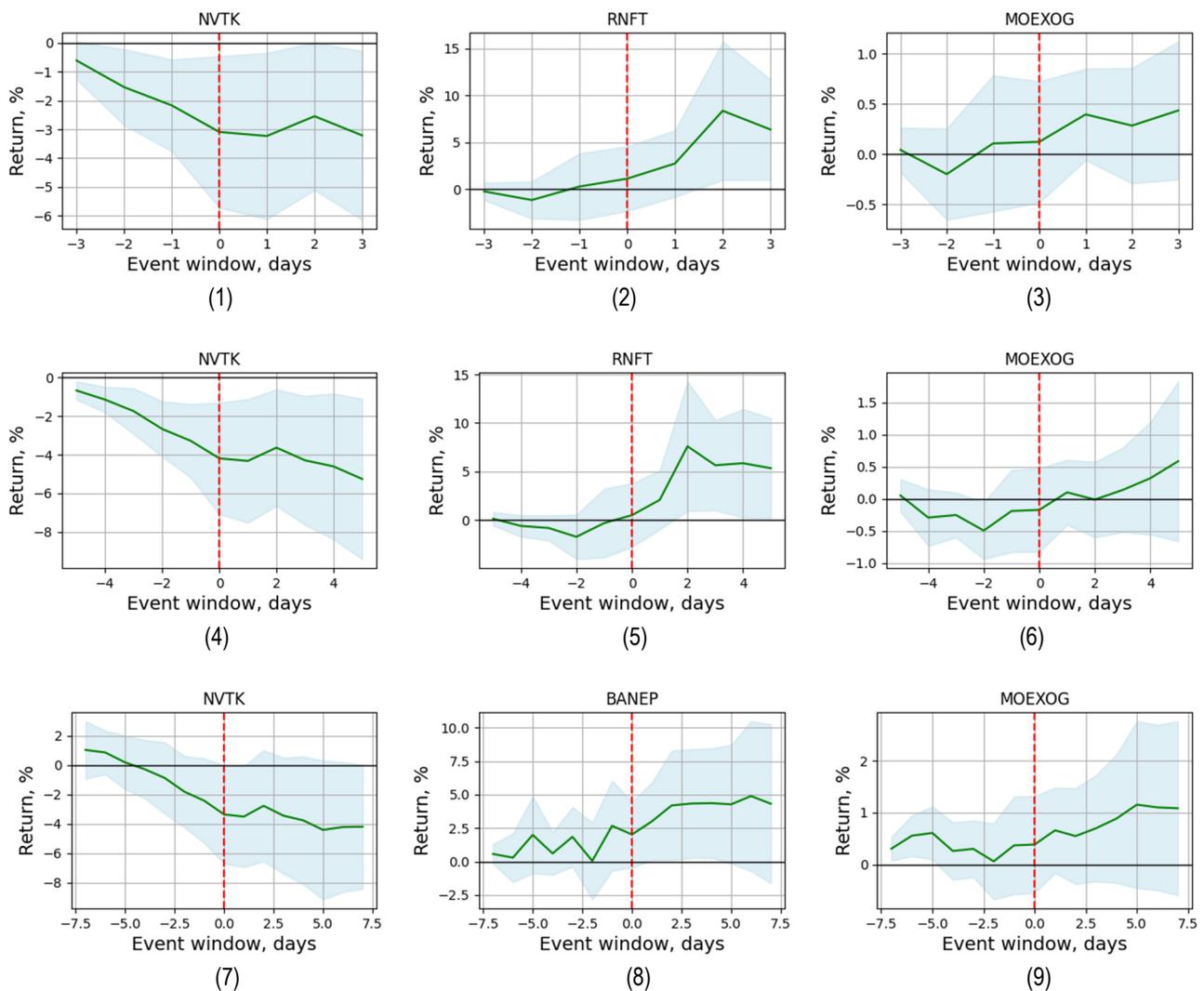
**Table 4:** Descriptive statistics for oil and gas stocks CAAR, % with different event window

	[-3, 3]	[-5, 5]	[-7, 7]
Count	11	11	11
Mean	1,39	1,39	2,13
Std	2,58	3,08	2,57
Minimum	-3,21 (NVTK)	-5,25 (NVTK)	-4,18 (NVTK)
Maximum	6,39 (RNFT)	5,34 (RNFT)	4,32 (BANEP)
MOEXOG	0,43	0,59	1,09

Source: The author's calculation

The positive result for the mean CAAR of 2.13 percentage points and the MOEXOG CAAR of 1.09 percentage points for the 15-day event window in Table 4 is in complete contrast to the results of Biermann & Leromain (2023) where the common cumulative stock returns of a broad global sample showed negative values of -4.51 percentage points in February-March 2022.

Picture 1 shows the CAAR plots for securities with the minimum and maximum total CAAR, and CAAR for the MOEXOG index for various event windows: figures 1.1-1.3 for the 7-day window, figures 1.4-1.6 for the 9-day window, and figures 1.7-1.9 for the 15-day window. The graphs also show 90% confidence intervals.



**Picture 1:** Examples of CAAR performance (stocks with minimum and maximum final values, and MOEXOG index value) for different event windows. 90% asymptotic CI in blue color.

**Source:** The author's calculation

This abnormal result can be attributed to the fact that, initially in February-March 2022, Russian investors had factored into the prices many more negative scenarios than those that were realized when the sanctions packages were announced. Moreover, positive abnormal returns indicate optimism and insufficient severity of sanctions in the investors' perception.

## 5. CONCLUSION

This study has analyzed the impact of the European Union economic sanctions on the Russian oil and gas sector, a critical area given the EU's former status as one of Russia's main trading partners. Through the method of a firm-specific event study focusing on eight public companies listed on the Moscow Exchange, the paper has examined the market's reaction to the sanction announcements. Despite the anticipation and the severity of the sanctions imposed, the findings reveal a predominantly negligible impact on the capitalization of the above-mentioned Russian companies. This outcome underscores the limitations of sanctions in exerting immediate financial pressure, as evidenced by the unexpectedly positive CAAR values for the majority of the examined securities.

Furthermore, the analysis extends beyond mere financial metrics to consider the broader implications of sanctions on investor sentiment and market dynamics. The positive abnormal returns observed in several cases suggest a nuanced market perception that may view the sanctions as either insufficiently severe or unlikely to present significant risks to the targeted sectors. This perception, mirrored in the resilience of the Russian stock market, especially in the oil and gas sector, suggests a possible disconnect between the intended punitive effects of sanctions and their actual impact on market confidence. Such insights contribute to the ongoing debate on the effectiveness of sanctions, highlighting the complexity of economic responses and the potential for unintended outcomes in the sanctions' wake.

This study's limitations, particularly the focus on a specific sector and a limited number of companies examined, offer avenues for future research. An expanded analysis could explore the impact of sanctions across different sectors and event dataset from other sanctions imposers to provide a fuller picture of their economic implications.

In conclusion, the findings of this paper contribute to the ongoing debate about the utility and efficacy of economic sanctions. As the international community continues to grapple with the challenges of implementing effective sanctions, the insights from this study on the Russian oil and gas sector offer a critical perspective on the limitations and potential unintended consequences of such measures.

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**Jovica Pejčić**

Faculty of Economics in Subotica,  
 University of Novi Sad, Subotica,  
 Republic of Serbia  
 jovica.pejčić@ef.uns.ac.rs

**Oljica Glavaški**

Faculty of Economics in Subotica,  
 University of Novi Sad, Subotica,  
 Republic of Serbia  
 oljica.glavaski@ef.uns.ac.rs

**Aleksandar Sekulić**

Faculty of Economics in Subotica,  
 University of Novi Sad, Subotica, Republic  
 of Serbia  
 aleksandar.sekulic@ef.uns.ac.rs

## **INFLATIONARY PRESSURES IN THE CONDITIONS OF GLOBAL UNCERTAINTIES: EVIDENCE FROM DEVELOPED EUROPEAN ECONOMIES<sup>1</sup>**

**Abstract:** This paper analyzes the key macroeconomic consequences that are directly determined by the pandemic and geopolitical crisis in the form of growing inflationary pressures, reflecting a high level of uncertainty during decision-making and planning at the individual, business and macroeconomic level. The subject of the econometric analysis aims to see how the movement of oil prices affects the consumer price index (*CPI*) on a sample of 15 developed European economies in the period from 2020q1-2023q4. Using heterogeneous panel models, specifically Mean Group (MG), and Pooled Mean Group (PMG) methods positive and heterogeneous impact of the increase in the price of crude oil on *CPI* is detected. Research indicates that the long-run relationship and speed of adjustment of individual economies to the long-run equilibrium relationship is heterogeneous during the analyzed period, indicating that the effect of macroeconomic uncertainties represented in crude oil price increase had different magnitude of influence in developed European economies. Individual adjustments were the most intensive in Greece, France, and Portugal, meaning that those economies were more exposed to higher inflationary pressures, while a slower intensity of adjustment and lower inflationary pressures were present in Austria, Belgium, Finland, and Luxembourg. Detected vulnerability of developed European economies in the circumstances of global uncertainties is expected due to absence of mechanisms to achieve countercyclical effects on the growth of inflation.

**Keywords:** consumer price index, crude oil price, heterogeneous panels, developed European economies.

### **1. INTRODUCTION**

One of the crucial macroeconomic indicators that reflects the economic strength of the national economy and manifests the purchasing power and living standards of the population is the Consumer Price Index (*CPI*) - proxy for inflationary pressures. Economic policymakers will agree that stable and low inflation rates are the primary goal of any monetary policy. When inflation becomes prevalent within the economy, the expectation of further increases in price levels becomes a major concern in the minds of consumers and businesses. There are various indicators that lead to an increase in the price level within an economy. On the one hand, an increase in the price

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level can be generated by increased consumer demand, while on the other hand, inflation can also grow based on developments that have no direct connection with economic preconditions, such as, for example, restrictions related to oil production and problems in the supply chain (Trunin and Perewyshin 2023).

Analyzing the harmfulness of the phenomenon of a general increase in price levels, it is necessary to consider whether the increase in inflation leads to negative repercussions and causes problems in the functioning of the economic system, or whether it is a matter of controlled price growth that can lead to higher wages and new jobs. Also, it is important to point out that inflationary pressure does not affect all categories of the population with the same intensity. In addition to the dynamics of the price level increase, it is important to point out that inflation has the strongest effect on those categories of the population that achieve the lowest level of income - the poorest. However, the current circumstances, which are a reflection of the exogenous health shock (2020) caused by the pandemic crisis COVID-19 and geopolitical turbulence in the relationship between Russia and Ukraine (2022), have created inflationary pressures and drastically reduced the chance of economic recovery for the largest number of countries (Greenwood and Hanke 2022). Mention period is precisely focus of this paper, from escalation of COVID-19 crisis – first quarter of 2020, to the last available data – fourth quarter of 2023. Since that majority of economies were attacked by reduction of aggregate demand during the pandemic crisis, broken supply chains, and reduction of aggregate supply during geopolitical crisis, consequence was inflationary pressures. The most important factor which could be trigger of the inflation is increase of crude oil price, which rose during all analyzed period, achieving pick in the second quarter of 2022, right after the beginning of Russian-Ukraine war. Economies that were especially exposed to the influence of crude oil price rise were European economies, traditionally dependent of foreign crude oil sources, i.e. European economies are with the relatively highest degree of import dependence in the global economy (Stojkov, Beker Pucar, & Sekulić, 2023). Special interest in this paper is on developed European economies and how vulnerable those economies were in the period of global uncertainty, particularly in the context of inflationary pressures created as the reaction of crude oil price growth. The sample contains 15 developed European economies, that correspond former EU-15<sup>2</sup>. Although it seems that sample is relatively homogeneous, we are aware that heterogeneous aspects exist in the sample: they are all European economies, but they are not all member of European Union (EU), if they are members of the EU, some of them are not member of Eurozone, therefore those economies do not have common monetary, nor fiscal policy. Therefore, heterogeneous panel models are implemented in this paper, in order to account for potential differences which determines inflationary pressures.

The paper contains threefold objectives: (1) to indicate and interpret the harmfulness of the sudden rise in price levels in a sample of 15 European developed countries in the period 2020q1 -2023q4, which was caused by the pandemic and geopolitical crisis, (2) to descriptive statistics show the movement of the oil price level and the observed consumer price index. on a sample of 15 European developed countries in the period 2020q1 -2023q4, (3) and to apply heterogeneous panel models in order to determine whether there is a long-run equilibrium relationship between the consumer price index, which systematizes inflationary pressures, and the price of crude oil in a sample of 15 European developed countries in the period 2020q1 - 2023q4, as well as for assessing the speed of adjustments of individual economies to the long-run equilibrium relationship. The hypotheses analyzed in the paper are as follows:

*H<sub>1</sub>: The long-run equilibrium relationship between the growth of crude oil prices and the consumer price indices that systematizes inflationary pressures exists in a sample of 15 European developed economies in the period 2020q1-2023q4.*

*H<sub>2</sub>: Long-run equilibrium relationship and speed of adjustments of individual economies to the long-run equilibrium relationship are heterogeneous in a sample of 15 European developed economies in the period 2020q1-2023q4.*

The rest of this paper is organized as follows: after the introduction, the second section presents a review of the literature, the third section presents a descriptive analysis of the consumer price index and crude oil prices, the fourth section presents an empirical analysis of key determinant of inflation, based on Polled Menag Group /Mean Group estimators. The last section of the paper outlines conclusions.

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<sup>2</sup> Austria, Belgium, Denmark, Finland, France, Germany, United Kingdom, Greece, Ireland, Italy, Luxemburg, Netherlands, Portugal, Spain, Sweden.

## 2. LITERATURE REVIEW

Pronounced, dynamic and persistent growth of inflation is an indispensable macroeconomic topic that is hotly debated. Inflation at the global level has reached multi-decade highs, far exceeding the targets of monetary goals as well as the forecasts of economic policy makers. This paper presents different views of economists who point to the enormous harm of monetary instability viewed through a sudden rise in price levels during the functioning of the entire economic system. Also, indicating that rising inflation is not the only macroeconomic problem affecting the global economy. Ascari, Bonham and Smadu (2024) point out that the main trigger of the price level increase within the Eurozone was caused by a "broken" supply chain, delays in the delivery of goods and insufficient energy raw materials during the pandemic crisis, which was then prolonged by geopolitical instability. Verbrugge and Zaman (2023) indicate that curbing inflation is one of the key challenges for economic policymakers around the world in 2022. As a result, the central banks suppressed the growing inflationary pressures by tightening the monetary policy. A strong response in the form of restrictive monetary policy and rising interest rates occurred in those countries whose economies faced inflationary pressures caused not only on the supply side, but also on the demand side. Lydon (2023) indicates that the COVID-19 epidemic combined with the war in Ukraine contributed to record high inflation rates in Europe. Analyzing the movement of real wages, the resilience of the household was tested by a sharp rise in prices. Conducted research indicates that inflation caused a burdensome effect on those households with limited savings, where food and energy consumption had a dominant position in the consumption structure. Dreger (2023) indicates in his paper that the period of price stability was present from 2008 and the global financial crisis, until the current world turbulence. Based on the structural VAR model, during the pandemic crisis (2020-2022), he points out that demand-side shocks were dominant in the economy of the United States of America (USA) and explained approximately 75% of inflationary growth, while supply-side inflationary shocks were generated mostly by narrow throats in global supply chains and make up the remaining 25% of inflation growth. According to the author, a similar scenario was seen on the territory of Europe. Cline (2023) points out in his work that the current war escalation between Russia and Ukraine has produced almost the highest rate of inflation in the last four decades, both in the USA and in other countries throughout Europe. The focus of the research is on the movement of inflation in conditions of supply shortage and increased demand. Lutz and Zhou (2023) point out that it is necessary to distinguish between crude oil and electricity as an integral component of any economy, indicating that electricity represents an essential cost component in any economy. In their research, they claim that the energy price shock cannot be seen as a one-time event, as in the case of oil price shocks during the 70s of the last century, but that it is a far more complex component in the functioning of the modern economy.

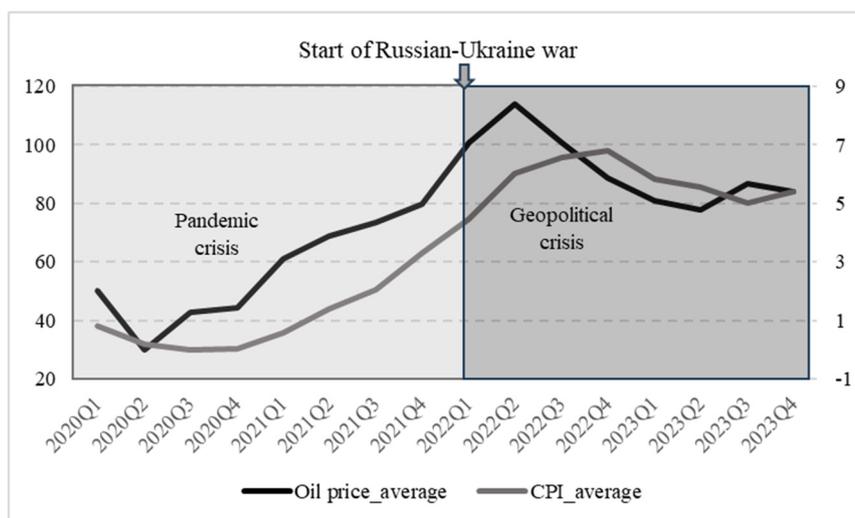
Knuth (2023) interprets that the increase in price levels is not the only anomaly facing the global economy. After three years of uncertainty caused by the pandemic, the crisis deepened in the sphere of geopolitical circumstances, and in response to the war actions in the territory of Ukraine, economic sanctions were introduced that were aimed at Russia, and actually dramatically affected the European economy. Analyzing the labor market in the period from February 2020 to June 2022, there is an increase in the unemployment rate, which is accompanied by more modest economic activities, i.e. a negative rate of economic growth in the most developed economy of the European Union, especially in Germany. Benabed and Bulgaru (2023) indicate that global economic growth observed in the last three years has been extremely unstable. The long-run effects of the pandemic, limited energy supply, unstable geopolitical circumstances, presented economic policy makers with two potential alternatives: (1) rising inflation and continuous decline in the purchasing power of the population, accompanied by investment uncertainties or (2) the return of the inflation rate within the framework of monetary targets, followed by lower macro performance. Based on the decisions made and the restrictive monetary policy implemented, presented by the growth of interest rates, the economies accepted the achievement of monetary goals at the expense of fiscal goals. Binduja (2023) indicates in his work that supply shocks can have more far-reaching negative effects on fiscal policy objectives. Higher interest rates and restrictive monetary policy can dampen inflation due to their adverse effect on the demand side. However, supply factors are beyond the control of central banks. Therefore, if the monetary policy were too restrictive, the economic environment could simultaneously face lower rates of economic growth, which in economic theory would potentially indicate the presence of stagflation. Dierks (2023) predicts that the simultaneous combination of economic stagnation and rising inflation will probably be present in a small number of economies throughout the Eurozone, but due to the unique position of the European Central Bank in the form of a tightening of monetary policy, which should harmonize current inflation and monetary expectations regarding this indicator, will be at the expense of lower economic growth and rising unemployment. Moreover, in their research Pejčić, Glavaški, & Sekulić (2022) showed that not only inflationary pressures, but as

well recessionary pressures existed in the period of pandemic and geopolitical crisis in 18 developed economies. The contribution of this paper is to fill a gap in the literature that analyzes the existence of a long-run equilibrium relationship between the growth of the price of crude oil and the consumer price index, as well as the dynamics of adjustment of individual economies to the long-run equilibrium in a sample of fifteen European developed countries during the analyzed period 2020q1-2023q4.

### 3. DESCRIPTIVE ANALYSIS – INFLATIONARY PRESSURES

The essential question arises, what causes the rise in inflation? If a short-run time interval is taken into analysis, rising inflation may be the result of a "hot" economy - one in which the population has excess cash or has economical access to credit, and wants to spend more. If the level of demand from consumers is high enough when buying goods and services, companies can decide to raise the price level and thereby directly improve their profit status, without losing customers. On the other hand, if it is a longer-run factor, which is of a structural nature or represents a certain discontinuity, such as a pandemic or current geopolitical crisis, then the situation is incomparably more complex and is reflected in reduced production, limited supply, which implies a rise in prices. The price of electricity, agricultural - food products and crude oil reached their maximum during the crisis period. Therefore, we can conclude that the sharp rise in energy prices has far-reaching consequences, not only on end consumers but also on the economy as a whole.

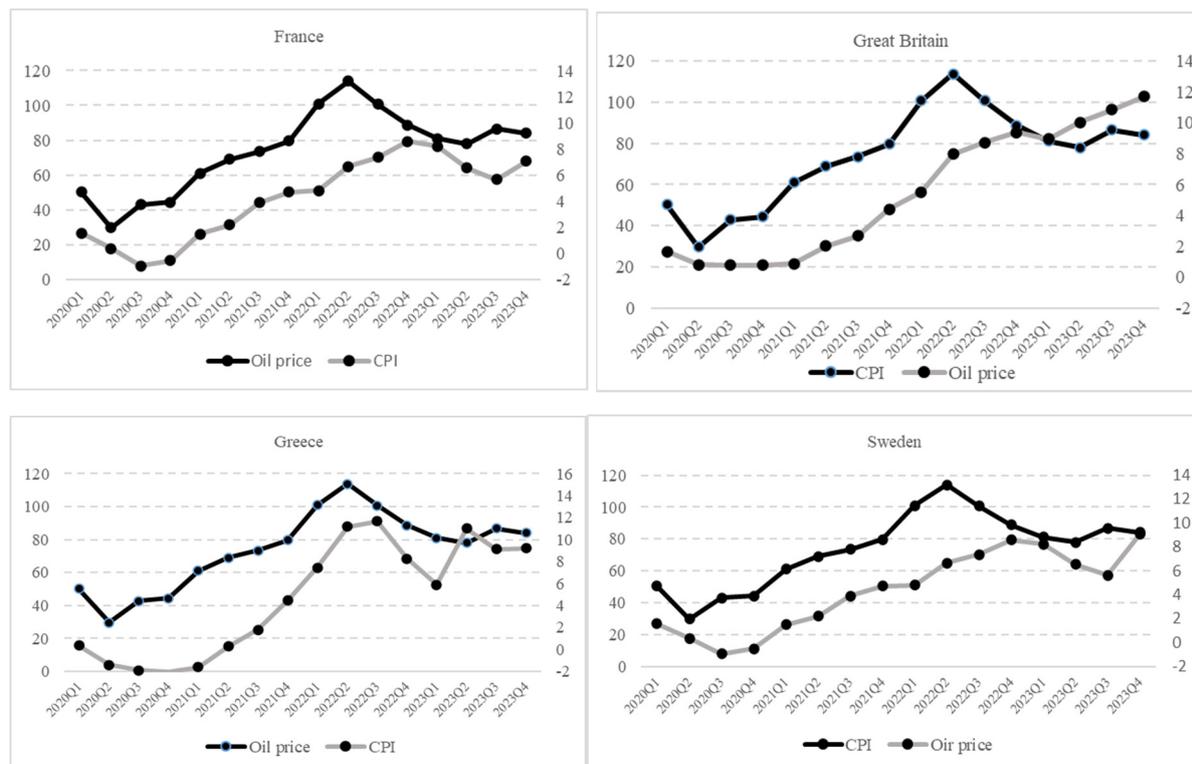
Figure 1 shows the movement of the average price of crude oil and the average consumer price index in a sample of 15 European countries in the period from 2020q1-2023q4<sup>3</sup>. Timeline is separated in two parts, first, at the left side during the pandemic crisis, and second, on the right side, showing effects during geopolitical crisis. The pandemic crisis has restricted movement globally, resulting in a drop in demand of more than 30 million barrels of oil in early April 2020 (International Energy Agency, 2020). In the context of oil price, war between Russia and Saudi Arabia, supply chain blockades, restrictions of production and business activities, caused the steepest drop in oil prices in history. After that historical minimum in the second quarter of 2020 (\$37.63 per barrel), there has been an exponential growth in the price of crude oil, which had impact on the consumer price index growth. Namely, trends of those variables are similar, confirming that rise of crude oil price is one of the most important determinants of inflation. After the beginning of Russian-Ukraine war, oil price continued to grow, while the highest level of the price of crude oil was recorded in the second quarter of 2022, after which it began to decline slightly. Similar trend but with time-lag of about two quarters (fourth quarter of 2022) had average inflation, when average inflation started to decline.



**Figure 1:** Average crude oil price movement and average *CPI* in 15 developed European economies (2020q1-2023q4)  
**Source:** Authors according to FRED.

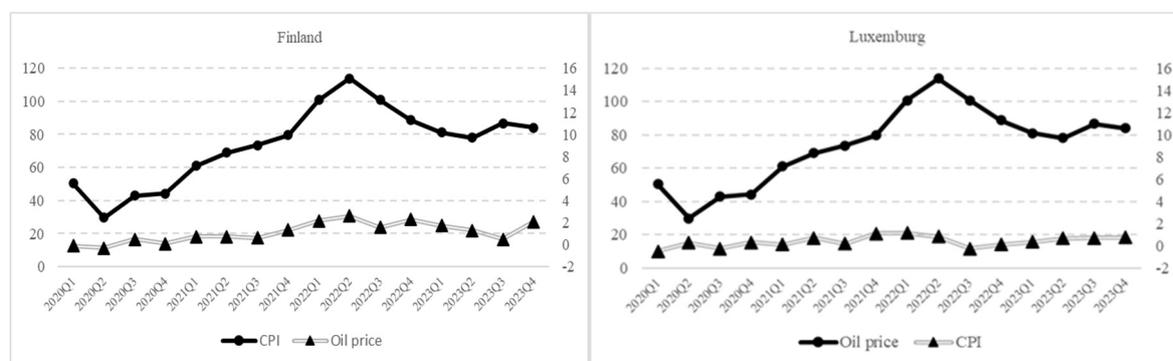
<sup>3</sup> Source of data: Federal Reserve Economic Data (FRED). <https://fred.stlouisfed.org/>

Although, decline in *CPI* on average has started in 2023, that is not a case in all European developed economies. Namely, the same change of oil prices effected differently on *CPI* indices, i.e. depending on other factors that generated further grow of inflation. Figure 2 show inflationary pressures measured by *CPI* in selected economies from the sample (France, Great Britain, Sweden, Greece) in which inflationary pressure existed until the fourth quarter of 2023.



**Figure 2:** High inflationary pressures in France, United Kingdom, Greece, Sweden in the period 2020q1-2023q4  
**Source:** Authors, according to FRED.

On the other hand, common rise of crude oil prices did not affect the creation of inflationary pressures, for example, in Finland and Luxemburg. In those economies, *CPI* indices were stable not only during pandemic crisis, but as well during geopolitical crisis (Figure 3). Belgium is different example, since that Belgium was exposed to inflationary pressures from the first quarter of 2021 till fourth quarter of 2022 (*CPI* value 11.08), however, those effects were neutralized till 2023q4 (*CPI* value 0.822).



**Figure 3:** Low inflationary pressures in Finland and Luxemburg in the period 2020q1-2023q4  
**Source:** Authors according to FRED.

According to descriptive analysis, France, United Kingdom, Sweden and Greece recorded a sharp increase in the price level directly caused by the increase in the price of crude oil, while in Finland and Luxembourg the increase in the price of oil did not play a crucial role in the increase of consumer price index in the observed period. Therefore, we could conclude that effects of common growth of crude oil prices had heterogeneous impact on inflationary pressures determination.

#### 4. EMPIRICAL ANALYSIS IN DEVELOPED EUROPEAN ECONOMIES

Empirical analysis is based on panel analysis containing of 15 cross-sectional units (15 developed European economies) during the period 2020q1-2023q4. Therefore, the number of observations included in the panel is 240, where the variable *CPI* represents the consumer price index used as dependent variable. Large differences in the case of minimum *versus* maximum values of the consumer price index exist. The lowest *CPI* level was recorded in the 4th quarter of 2020 in Greece (-2.051), while the highest *CPI* level was achieved in Ireland in the 4th quarter of 2023 (12.7668). The variable *OILPRICES* refers to the price of crude oil, the mean value of which is 74.01239. The price of crude oil during the observed period recorded progressive dynamics, reaching its maximum in the 2nd quarter of 2022, amounting to 113.8352.

The procedure for determining the long-run and short-run equilibrium relationship between *CPI* and *OILPRICES* consists of the following empirical steps (Blackburne & Frank 2007). Cross-sectional dependency in the sample (Beck & Katz, 1995), conditioned the use of second generation of panel unit root test – Pesaran CIPS test (2007). Table 1 shows Pesaran CD, Pesaran CIPS and Westerlund cointegration test. Based on the Pesaran CD test, we conclude that there is a dependency of the because the analyzed countries are mutually dependent. Based on unit root tests (Im et al. 2003), the analyzed variables: consumer price index and crude oil price are non-stationary, i.e. panel unit root tests fail to reject the null hypothesis of variable non-stationarity at the 5% significance level, which means that the variables *CPI* and *OILPRICES* are non-stationary. Then, the stationarity of the first differences of variables is tested. The results of the Pesaran CIPS test showed the stationarity of the variables first differences, that is, all the variables in the model are integrated of the first order, which is the basis for the cointegration relationship. In applying Westerlund's (2007) cointegration test, an important assumption is based on the assumptions of the test. Due to the fact that cross-sectional dependence exists in the panel, Westerlund's (2007) test could provide a relevant conclusion, but only after a bootstrapping procedure. Robust p-values are calculated using a 400-step bootstrap procedure. The conclusion related to the Westerlund test using group mean tests (Gt and Ga) and pooled panel tests (Pt and Pa) is that at least one panel unit or all panel units are cointegrated, and therefore it is necessary to estimate heterogeneous coefficients to determine in which panel units (countries) there is a cointegration relationship, and in which countries it does not exist. The null hypothesis indicates that there is no cointegrating relationship, compared to the alternative relationship that indicates the existence of cointegration between non-stationary variables. The results based on the Westerlund test show that the null hypothesis is rejected, which means that *CPI* and *OILPRICES* are cointegrated. The Mean Group (MG) and Pooled Mean Group (PMG) methods defined by Pesaran et al. (1997, 1999) are further used to estimate the long-run equilibrium relationship between the consumer price index and the price of crude oil, as well as the speed of adjustment of individual economies to the long-run relationship.

**Table 1:** Pesaran CD test, Pesaran CIPS test and Westerlund cointegration test

Variables	Pesaran CD test	p-values	Lags	CIPS panel unit root test in the level	p-values	CIPS test at the first differences	p-values	Westerlund cointegration test		Robust p-values (bootstrap)
			0	-13.16	0.041	-9.865	0.000	Gt	-1.072	0.031
<i>CPI</i>	30.92	0.000	1	-3.444	0.059	-7.345	0.000	Ga	-1.508	0.005
			2	-3.221	0.821	-3.556	0.000			
			0	43.476	0.003	37.568	0.000			
<i>OILPRICES</i>	40.99	0.000	1	98.932	0.061	26.981	0.000	Pt	-5.069	0.032
			2	153.116	0.093	18.935	0.000	Pa	-0.507	0.0385

Source: Author's calculation.

In Table 2, using the MG and PMG methods, the existence of a long-run equilibrium relationship between the consumer price index and the price of crude oil is assessed, as well as the dynamics of adjustment of individual economies to the long-run equilibrium relationship. Based on the obtained results of homogeneous coefficients in both cases, the cointegration relationship is statistically significant and positive: 0.413 in the MG model, and 0.637 in the PMG model. In the comparison of the two methods, a higher long-run coefficient is estimated in the Pooled Mean Group (PMG) method. Given that the error correction parameter is significant and negative, showing the speed of adjustment towards long-run equilibrium, the total adjustment in the MG model is -0.3664, indicating that 36.64% of the deviation is corrected in one year, while the adjustment in the PMG model is -0.0547, indicating that 5.47% of deviations were corrected on average in one year. However, Hausman's test for long-run homogeneity of the relationship showed that the MG method provides an optimal specification, with consistent and efficient estimates, given the heterogeneous structure of the entire economic environment of the observed countries.

**Table 2:** Results of PMG and MG estimator for homogeneous coefficient for 15 developed European economies in the period from 2020q1-2023q4

Dependent Variable <i>CPI</i>	Long-Run Equilibrium		Error-Correction		$\Delta OILPRICES$		$\mu_i$	
	Coef.	p-value	Coef.	p-value	Coef.	p-value	Coef.	p-value
PMG	0.637	0.000	-0.0547	0.000	0.0014	0.874	1.8386	0.088
MG	0.413	0.000	-0.366	0.001	0.021	0.002	1.0763	0.428
Hausman test statistic	20.74							

Source: Author's calculation.

Table 3, shows the heterogeneous impact of crude oil price growth on the consumer price index using the MG method. Based on the obtained results, we conclude that there is a heterogeneous long-run equilibrium relationship between the growth of the consumer price index and the growth of crude oil prices. The stated effect was the most pronounced in Italy, the Netherlands, Austria, Germany, Spain and Greece, while a weaker, but statistically significant effect was present in Denmark, Finland, Ireland, France, Portugal, Belgium and Sweden.

**Table 3:** Results of the MG Estimator for the heterogeneous coefficient in the 15 developed European economies in the period from 2020q1-2023q4

MG ESTIMATOR	Long-run		Error-Correction		$\Delta OILPRICES$		$\mu_i$	
	Coeff.	p-value	Coeff.	p-value	Coeff.	p-value	Coeff.	p-value
ITALY	<b>0.6612</b>	<b>0.046</b>	-0.0848	0.104	-0.0424	0.115	6.3511	0.217
GERMANY	<b>0.7503</b>	<b>0.000</b>	-0.0546	0.000	-0.058	0.006	-3.047	0.015
FRANCES	<b>0.1445</b>	<b>0.000</b>	<b>-0.6055</b>	<b>0.003</b>	-0.5067	0.004	-2.987	0.001
PORTUGAL	<b>0.4135</b>	<b>0.006</b>	<b>-0.5854</b>	<b>0.000</b>	-0.4565	0.000	12.445	0.064
GREECE	<b>0.633</b>	<b>0.000</b>	<b>-0.7129</b>	<b>0.000</b>	-0.7865	0.000	-6.342	0.001
SPAIN	<b>0.6098</b>	<b>0.009</b>	-1.3538	0.001	0.1763	0.029	-0.3345	0.491
BELGIUM	<b>0.1554</b>	<b>0.000</b>	<b>-0.1147</b>	<b>0.002</b>	-0.009	0.043	-2.916	0.004
NETHERLANDS	<b>0.5918</b>	<b>0.010</b>	-0.1122	0.061	-0.041	0.214	9.584	0.057
UNITED KINGDOM	0.4892	0.123	-0.987	0.226	0.1059	0.226	3.334	0.490
LUXEMBOURG	0.0701	0.340	<b>-0.045</b>	<b>0.000</b>	-0.1132	0.003	0.039	0.10
FINLAND	<b>0.0987</b>	<b>0.045</b>	<b>-0.3429</b>	<b>0.012</b>	-0.054	0.017	3.084	0.274
SWEDEN	<b>0.4197</b>	<b>0.014</b>	-0.0704	0.058	0.0082	0.089	-1.824	0.000
AUSTRIA	<b>0.6876</b>	<b>0.005</b>	<b>-0.0983</b>	<b>0.004</b>	-0.069	0.014	-2.456	0.113
DENMARK	<b>0.1415</b>	<b>0.011</b>	-0.3620	0.112	-0.0139	0.796	3.1425	0.440
IRELAND	<b>0.0960</b>	<b>0.039</b>	-0.0145	0.201	-0.01344	0.567	2.593	0.000

Source: Author's calculation

Also, Table 2 shows that the speed of adjustment of individual economies to the long-run equilibrium relationship is different. For example, individual adjustment to the long-run equilibrium relationship was the most intensive in Greece, France, and Portugal, meaning that those economies were more exposed to higher inflationary pressures, while a slower intensity of adjustment and lower inflationary pressures were present in Austria, Belgium, Finland, and Luxembourg. The conclusion is that almost all former EU-15 member countries in the observed period of 2020q1-2023q4 experienced an increase in the consumer price index, but with different intensity. The reasons that directly argue the interpreted results are: (1) the heterogeneous fiscal policy, which is based only on coordination between EU member states, in the form of public spending and taxes, which is not unique; (2) monetary policy that is only partially unique, namely, some analyzed economies are not members of

the Eurozone (Czech Republic, Denmark and Sweden) which reflects on heterogeneous impacts; (3) exit of United Kingdom from the European Union - Brexit (2020) and orientation toward sovereign economic policies. Therefore, the structure of the economic environment of the member countries is of a heterogeneous nature. For instance, Germany is a manufacturing-industrial country, which indicates that any stagnation in the sphere of production, limited supply of oil derivatives or electricity, directly reflects negative repercussions on macroeconomic indicators. While Belgium, for example, is targeted as a "country of EU institutions", where the largest number of EU institutions exist legally and commercially, but despite this, it is known at a high level for the development of energy, metallurgy, and food production. Finally, we conclude that hypothesis 1 and hypothesis 2 are confirmed, i.e. that there is a long-run equilibrium relationship between the growth of crude oil prices and the consumer price index, as well as that the dynamics of adjustment of individual economies to the long-run equilibrium relationship during the analyzed period 2020q1-2023q4 on a sample of developed European countries is different.

## 5. CONCLUSION

After achieving historical minimum in the second quarter of 2020, the sudden increase in the price of crude oil occurred and lasted till the second quarter of 2022. In that period increase of the oil prices had positively effects on the growth of the consumer price index. The analyzed period in this paper, covering period 2020q1-2023q4, beside oil price growth was characterized by aggregate demand contraction and broken supply chains during pandemic crisis, while restrictions in the production and delivery of petroleum products during geopolitical crisis. Although, those effects together with macroeconomic policy reactions in context of fiscal expansion in the period of pandemic and monetary restrictions in the period of geopolitical crisis had impact on inflation, the focus of this paper was on specific effect of crude oil price on inflationary pressures. The econometric analysis applied in the paper, which is based on the use of a heterogeneous panel models, specifically the MG and PMG methods, showed that there is a long-run equilibrium relationship between the growth of crude oil prices and the growth of consumer prices indices on a sample of 15 European developed countries in the period 2020q1-2023q4, i.e. we can conclude that Hypothesis ( $H_1$ ) is accepted. In addition, Hypothesis ( $H_2$ ) is also accepted, indicating heterogeneous long-run equilibrium relationships and heterogeneous speed of adjustments of individual economies to the long-run equilibrium relationship. Heterogeneity of these relations is the consequence of functioning of the European developed economies (without common fiscal policy and partially common monetary policy in the sample), namely, not all countries were faced the growth of the consumer price index with the same intensity due to the increase in the price of crude oil. Individual adjustment to the long-run equilibrium relationship was the most intensive in Greece, France, and Portugal, meaning that those economies were more exposed to higher inflationary pressures, while a slower intensity of adjustment and lower inflationary pressures were present in Austria, Belgium, Finland, and Luxembourg. Detected vulnerability in the circumstances of global uncertainty is expected due to absence of mechanisms to achieve countercyclical effects on the growth of inflation. Therefore, the recommendation is oriented towards increase of renewable energy sources, especially in times of unstable supply of fossil fuels due to geopolitical instability, which represents the main goals and challenges of policy makers in the period ahead.

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### **Nenad Benović**

PhD student  
 University of Novi Sad, Faculty of Economics  
 in Subotica,  
 Subotica, Republic of Serbia

e-mail: nenad.benovic@gmail.com

### **Ivan Milenković**

PhD, full professor  
 University of Novi Sad, Faculty of Economics  
 in Subotica,  
 Subotica, Republic of Serbia

e-mail: ivan.milenkovic@ef.uns.ac.rs

## **ANALYSIS OF THE INFLUENCE OF SELECTED MACROECONOMIC VARIABLES ON THE PUBLIC DEBT OF SERBIA**

**Abstract:** Controlling public debt is one of the most significant challenges faced by contemporary states. The aim of this study is to examine the relationship between the level of public debt and selected macroeconomic variables in the Republic of Serbia. The empirical analysis, based on annual data from 2006 to 2023, includes, in addition to the public debt as a percentage of gross domestic product as a dependent variable, four selected macroeconomic indicators incorporated into the model as independent variables. For the purpose of the analysis, E-views and Stata software were used. Descriptive statistics were initially presented, followed by a series of diagnostic tests such as unit root test and the derivation of the correlation matrix to reject hypotheses of non-stationarity and multicollinearity. Finally, the Ordinary Least Squares (OLS) method was applied to interpret the effects of independent variables on the dependent variable. The research results can be significant for policymakers in defining activities aimed at maintaining the stability of public debt.

**Keywords:** public debt, Serbia, macroeconomic variables.

## **1. INTRODUCTION**

Controlling public debt is one of the most significant challenges faced by contemporary states. Therefore, an evaluation of factors affecting debt dynamics and debt sustainability is vital for designing prudent macroeconomic policy for any economy. There is no country whose fiscal stability is not affected by the geopolitical and economic crisis, especially underdeveloped and developing countries. The Republic of Serbia, like most countries in the region, is a developing country that was affected by the crisis caused by the COVID-19 pandemic as well as the war in Ukraine. Crises result in the destabilization of public finances, where most often there is a decrease in state income with an increase in state expenditures and the need for public borrowing. In the last few years, the issue of the level and sustainability of public debt in Europe has been raised because it is extremely important in the context of achieving and maintaining macroeconomic stability. Public debt in the Republic of Serbia reached its peak of 70% of gross domestic product (GDP) in 2015, after which it declined due to fiscal consolidation. By the end of 2019, public debt amounted to 51.9% of GDP. In 2020, once again, there was an increase in the debt-to-GDP ratio, followed by its stabilization and a more moderate decline over the period 2021–2023.

The aim of this study is to examine the relationship between the level of public debt and selected macroeconomic variables in the Republic of Serbia.

The paper is constructed as follows: After the introduction, the second part of the paper provides an overview of the literature, which presents research on the influence of various macroeconomic variables on public debt. The third part gives a description of the methodology and data used to examine the relationship between public debt, primary balance, interest rate, GDP growth, and stock-flow adjustment in the Republic of Serbia. The fourth and most important part of

the paper includes the results of the econometric models. The paper ends with a summary containing the main conclusions of the research and considerations for future research on this topic.

## 2. LITERATURE REVIEW

The existing literature on public debt determinants shows that the factors that can affect public debt are macroeconomic, political, institutional, and structural variables. The empirical studies estimating the main determinants of public debt remain scarce and limited. In this context, Pirtea, Nicolescu, and Mota (2013) analyze the factors that influence the debt-to-GDP ratio in Romania. They found that the primary fiscal balance, the real interest rate, the real GDP growth rate, and the exchange rate are significant factors. The same results were found by Dumitrescu (2014). A study conducted by Belguith and Omrane (2019) revealed that Tunisia's state debt is mostly determined by the primary deficit. Abdul (2006) used an econometric approach to analyze the domestic debt of Pakistan by determining various factors responsible for the growth of domestic debt. The sample period for estimation was from 1991 to 2002. The ordinary least squares (OLS) method was used to estimate the parameters of the equation. The results of the study confirmed that the primary balance and interest rate payments were relevant in explaining the accumulation of domestic debt in Pakistan during the period under study. Abbas et al. (2013) suggest that the structural primary budget balance and economic growth are the key determinants of large previous public debt reductions in the analyzed advanced economies. The research by Gargouri and Ksantini (2016) was conducted on a sample of 12 European countries and indicated a statistically significant and negative impact of GDP growth on public debt. Pegkas, Staikouras, and Tsamadias (2020) use AMECO data and find that there is a negative long-run effect of public debt on growth. The results indicate that there is long-run bidirectional causality between public debt and growth. The sample includes twelve Eurozone countries. The authors recommend that Eurozone countries base their growth strategies on fiscal consolidation. Abubakar and Mamman (2020) use a two-stage least squares regression to estimate a model analyzing the effects of public debt on economic growth in 37 OECD countries. The authors examine the permanent versus transitory effects of public debt on GDP growth. The findings reveal that public debt exerts a significant negative permanent and positive transitory effect on GDP growth. The magnitude of the negative permanent effect of public debt was found to be larger than the positive transitory effect. In addition, while all country groups experienced negative permanent effects, not all country groups experienced positive transitory effects. Employing the two-stage least squares methodology, Ghourchian and Yilmazkuday (2020) compare the effects of public debt on economic growth in 83 countries from 1960 to 2014. The results reveal that a 1% increase in the debt-to-GDP ratio would reduce real GDP growth by about 0.01%, on average across countries. Checherita-Westphal and Rother (2012) use a two-stage least squares regression model with a control variable for fiscal balance and long-term real interest rates, among other factors. The authors analyze the impact of public debt on per capita GDP growth in 12 Euro Area countries from 1970 to 2011. They find a nonlinear impact of public debt on GDP growth with a turning point—beyond which the debt-to-GDP ratio has a deleterious impact on long-term growth—at about 90 to 100 percent of GDP. Eberhardt and Presbitero (2015) use OLS regressions to model the potential nonlinearity within and across countries in the debt-growth relationship. Observing a large dataset of 118 countries from 1961 to 2012, the authors find some support for a negative relationship between public debt and long-run growth across countries but no evidence for a similar, let alone common, debt threshold within countries. The properties of stock-flow adjustments have been studied in an early strand of literature, finding that they are nearly always and everywhere of relevant size. Campos, Jaimovich, and Panizza (2006) found that stock-flow adjustments are as important as government deficits in explaining fluctuations in government debt. Similar results were found by Abbas et al. (2011). Afonso and Jalles (2020) assess how stock-flow adjustments affect the debt-to-GDP ratio in 65 countries between 1985 and 2014. They found that stock-flow adjustments positively contribute to the change in the debt-to-GDP ratio with a coefficient close to one. So far, the literature has provided strong evidence that stock-flow adjustments are not purely erratic processes, being influenced by several macroeconomic variables such as output, inflation, and debt.

## 3. MATERIAL AND METHODS

As previously emphasized, the aim of this study is to examine the relationship between public debt, primary balance, GDP growth, interest rate, and stock-flow adjustment in the Republic of Serbia. In this chapter, the authors define the dependent and independent variables used in this study and state the hypotheses and main models that are the subject of testing, as well as the formulas of the diagnostic test used.

### 3.1. Data description

The empirical analysis, based on annual data from 2006 to 2023, includes, in addition to the public debt as a percentage of gross domestic product as a dependent variable, four selected macroeconomic indicators incorporated into the model

as independent variables. All the data used was downloaded from the website of the Ministry of Finance of the Republic of Serbia. The description of variables is provided in Table 1.

**Table 1:** Description of the researched variables

Variable name	Notation	Calculation	Role of variable
Public debt	PD	% of GDP	Dependent
Primary balance	PB	% of GDP	Independent
GDP growth rate	GDP	Annual %	Independent
Interest rate	IR	Annual %	Independent
Stock-flow adjustment	SFA	% of GDP	Independent

Source: Authors

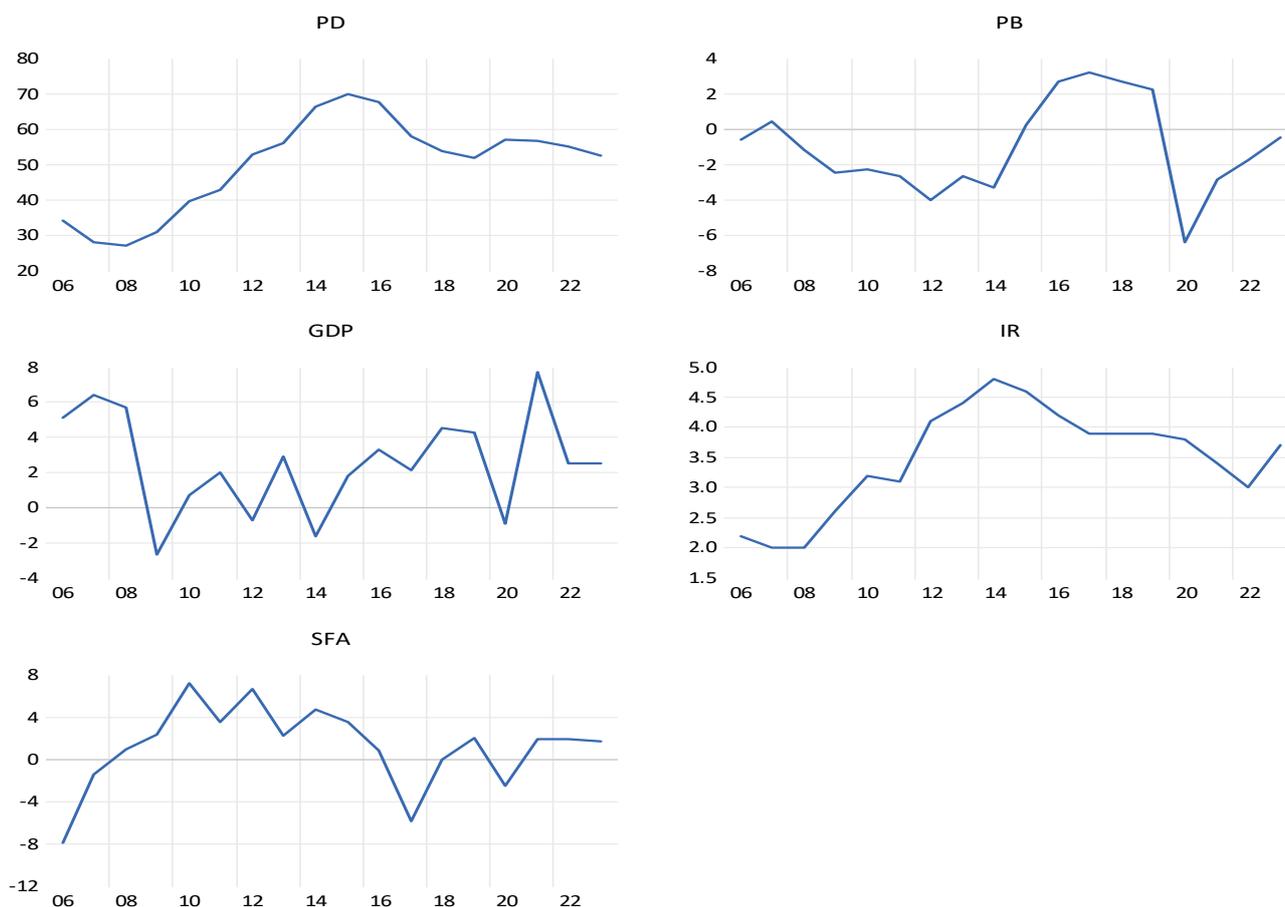
The interest rate (annual%) is calculated as the ratio between total interest payments at time t and the public debt stock at time t-1. Stock-flow adjustment (also known as debt-deficit adjustment) measures the difference between the overall fiscal balance and change in public debt, which in theory should be equal according to the underlying macroeconomic identity of debt accumulation. In reality, the sum of liabilities incurred never matches the overall fiscal balance. Stock-flow adjustment is generally a measurable variable, consisting of net flows of financial assets and other adjustments (transactions in financial derivatives, liabilities, impact of appreciation and depreciation of foreign currency on debt denominated in that currency, etc.), but the problem is that these data are not publicly available in Serbia. The calculation of the stock-flow adjustment is presented in Table 2.

**Table 2:** Stock-flow adjustment 2006-2023

In billions RSD	2006.	2007.	2008.	2009.	2010.	2011.	2012.	2013.	2014.
Public debt	738.81	703.25	778.04	944.41	1,282.54	1,547.51	2,014.75	2,309.04	2,753.20
Primary balance	-12.05	11.31	-34.26	-76.46	-74.13	-96.52	-150.73	-112.98	-139.00
Interest payments	19.28	14.81	13.88	20.02	30.13	40.34	63.15	89.26	110.36
Change in public debt	-140.36	-35.56	74.79	166.37	338.13	264.97	467.24	294.29	444.16
Stock-flow adjustment	-171.69	-39.06	26.65	69.89	233.87	128.11	253.36	92.05	194.80
Stock-flow adjustment (% of GDP)	-7.87	-1.55	0.92	2.29	7.19	3.55	6.65	2.23	4.68
In billions RSD	2015.	2016.	2017.	2018.	2019.	2020.	2021.	2022.	2023.
Public debt	3,018.59	3,064.61	2,751.12	2,720.20	2,815.64	3,135.79	3,543.24	3,909.89	4,236.15
Primary balance	10.61	120.12	152.01	137.72	119.58	-351.11	-179.18	-129.81	-41.25
Interest payments	125.76	128.07	118.16	106.50	106.83	108.07	106.90	105.36	146.59
Change in public debt	265.39	46.02	-313.49	-30.92	95.44	320.15	407.45	366.65	326.26
Stock-flow adjustment	150.24	38.07	-279.64	0.30	108.19	-139.03	121.37	131.48	138.42
Stock-flow adjustment (% of GDP)	3.48	0.84	-5.87	0.01	2.00	-2.53	1.94	1.85	1.71

Source: Authors' calculation based on the annual statistics by the Ministry of Finance of the Republic of Serbia

Picture 1 illustrates the movement of the selected variables in Serbia in the period 2006–2023. Until the global financial crisis, there was a gradual downward trend in public debt; however, there was an increase starting in 2009 and continuing until 2015, followed by a substantial decline. Again, in 2020, due to the crisis caused by the COVID-19 pandemic, there was an increase in public debt, followed by its stabilization and a more moderate decline over the period 2021–2023. The primary balance was in deficit from 2006 to 2014, with the exception of 2007, when a primary surplus was realized. The primary surplus was maintained from 2015 to 2019, followed by a period of primary deficit realization. In most of the observed period, GDP growth rates were positive, with the exception of 2009, 2012, 2014, and 2020, when GDP growth rates were negative due to the impact of the crisis and fiscal consolidation measures. The interest rate on public debt increased from 2.2% in 2006 to 4.8% in 2014, followed by a substantial decline and stabilization over the period 2015–2020. From 2021 to 2022, the interest rate declined from 3.8% to 3.0%, after which it began to rise, reaching 3.7% at the end of 2023. Stock-flow adjustment (calculated in Table 2) had negative values in 2006, 2007, 2017, and 2020, additionally influencing the reduction of public debt, while all other years of the observed period had positive values, additionally influencing the increase of public debt.



**Picture 1:** Movement of the selected variables in the period 2006-2023  
**Source:** Authors, based on the annual statistics by the Ministry of Finance of the Republic of Serbia.

### 3.2. Hypothesis and tests

The results of the previous theoretical and practical research and studies in this area served us as a basis for the selection of the variables and the initial hypotheses from which we started our research, as well as for drawing conclusions regarding the effect of the selected variables on the public debt of Serbia. The research is based on the following hypotheses:

- H01: The primary balance has a significant impact on the public debt of Serbia.
- H02: GDP growth has a significant impact on the public debt of Serbia.
- H03: The interest rate has a significant impact on the public debt of Serbia.
- H04: Stock-flow adjustment has a significant impact on the public debt of Serbia.

For the purpose of the analysis, E-views and Stata software were used. Descriptive statistics were initially presented, followed by a series of diagnostic tests such as the unit root test and the derivation of the correlation matrix to reject hypotheses of non-stationarity and multicollinearity. Finally, the Ordinary Least Squares (OLS) method was applied to interpret the effects of independent variables on the dependent variable.

After defining research hypotheses as well as reviewing the diagnostic tests, the authors derive the following regression model that represents the subject of this study:

$$PD_t = \alpha + \beta_1 PB_t + \beta_2 GDP_t + \beta_3 IR_t + \beta_4 SFA_t + \epsilon_t \quad (1)$$

Where:

- $PD_t$ , as a dependent variable, is the level of public debt as a percentage of GDP at time  $t$ .
- $PB_t$  is the primary balance as a percentage of GDP at time  $t$ .
- $GDP_t$  is the annual GDP growth rate in% at time  $t$ .
- $IR_t$  is the annual interest rate in% at time  $t$ .
- $SFA_t$  is stock-flow adjustment as a percentage of GDP at time  $t$ .
- $\epsilon_t$  is the white noise process.

## 4. RESULTS AND DISCUSSION

In the first stage of the analysis, the authors present descriptive statistics of the selected variables. The descriptive analysis presented in Table 3 shows that the highest amount of standard deviation (13.36%) is present in the public debt variable, which means that there is the largest spread between the minimum and maximum values of the indicator. The arithmetic mean of the public debt variable in the period from 2006 to 2023 in the Republic of Serbia is 49.93%, which could conditionally be taken as an indicator of the sustainability of the public debt in the analyzed period because it is below the limit determined by the Maastricht criteria. The average primary budget balance is in deficit and amounts to -1.08%, while the average GDP growth rate, interest rate, and stock-flow adjustment amount to 2.53%, 3.49%, and 1.19%, respectively.

**Table 3:** Descriptive statistics of the selected variables

Variables	Obs	Mean	Std. Dev.	Min	Max
PD	18	49.93333	13.35660	26.80000	70.00000
PB	18	-1.083333	2.616745	-6.400000	3.200000
GDP	18	2.533333	2.839428	-2.700000	7.700000
IR	18	3.488889	0.863569	2.000000	4.800000
SFA	18	1.188889	3.819130	-7.900000	7.200000

Source: Authors, Stata 13.0

One of the main conditions for performing a correct regression model is the absence of multicollinearity among independent variables. In order to prove the absence of multicollinearity, the authors use the correlation matrix as well as the variance inflation factor (VIF) test. Table 4 shows the correlation matrix in which the relationship between the dependent and independent variables is observed. It is noticeable that the level of correlation between the independent variables does not exceed the threshold of 0.80.

**Table 4:** Correlation matrix

	PD	PB	GDP	IR	SFA
PD	1.0000				
PB	0.0911	1.0000			
GDP	-0.2111	0.4539	1.0000		
IR	0.9147	0.0308	-0.3810	1.0000	
SFA	0.1788	-0.3459	-0.3682	0.3412	1.0000

Source: Authors, Stata 13.0

The VIF test, which shows us whether there is a high correlation between the independent variables, is also one of the necessary tests to check the validity of the data. If the variance inflation factor exceeds the threshold value of 10, the data is multicollinear and must be omitted from the regression model. According to Lin, Foster, and Ungar (2011), the VIF test was utilized for the analysis, and the computed regression is as follows:

$$VIF = 1 / (1 - R_j^2) \quad (2)$$

Where:

- VIF is the variance inflation factor.
- $R_j^2$  is the R square of the regression model.

The results of the VIF test presented in Table 5 show that there is no problem with multicollinearity of the used variables since the calculated value of VIF does not exceed the threshold value of 10.

**Table 5:** Variance inflation factor

Variables	VIF	1/VIF
PB	1.47	0.682558
GDP	1.58	0.630941
IR	1.37	0.728655
SFA	1.34	0.748316
<b>Mean VIF</b>	<b>1.44</b>	

Source: Authors, Stata 13.0

One of the requirements underlying the econometric analysis of time series is stationary data, which is the most crucial requirement for an econometric approach (Mushtaq, 2011). It speaks about time series' mean and variance as constant values. The data is not steady and has a unit root if the p-value is more than 0.05. Since using non-stationary data can lead to an unfavorable regression model (spurious regression), the unit root test is used to eliminate it. The Augmented

Dickey-Fuller (ADF) and Phillips-Perron (PP) unit root tests are applied to identify the order of integration of the variables. Table 6 summarizes the test results. According to the unit root test results, all the variables except the public debt and interest rate are stationary at level because the probability does not exceed the 5% significance level, while the public debt and interest rate data become stationary after performing the first difference.

**Table 6:** Unit root test

Variables	Level		1st difference	
	ADF	PP	ADF	PP
PD	0.133327 (0.7108)	0.199833 (0.7319)	-2.341890 <b>(0.0228)*</b>	-2.461569 <b>(0.0176)*</b>
PB	-2.090079 <b>(0.0385)*</b>	-2.135113 <b>(0.0351)*</b>	-4.376313 (0.0002)	-4.376313 (0.0002)
GDP	-4.093887 <b>(0.0066)*</b>	-4.101391 <b>(0.0065)*</b>	-4.943150 (0.0017)	-9.526304 (0.0000)
IR	0.440508 (0.7981)	0.357502 (0.7765)	-2.759599 <b>(0.0091)*</b>	-2.752467 <b>(0.0092)*</b>
SFA	-2.982877 <b>(0.0053)*</b>	-3.009849 <b>(0.0050)*</b>	-5.580088 (0.0000)	-5.869345 (0.0000)

Source: Authors, EViews 12

After diagnostic tests of multicollinearity and unit root, the authors use the OLS method to derive an adequate regression model. The results of OLS regression are presented in Table 7.

**Table 7:** Regression model

Variables	OLS
PB	<b>-0.812093</b> <b>(0.0011)*</b>
GDP	<b>-0.702646</b> <b>(0.0040)*</b>
DIR	-1.235957 (0.4098)
SFA	<b>1.044284</b> <b>(0.0001)*</b>
C	0.162649 (0.8326)
R - squared	<b>0.928404</b>
Prob.	<b>0.000001</b>

Source: Authors, EViews 12

Based on the obtained results, we note that the influence of all independent variables, except the interest rate, proved to be statistically significant. Therefore, we cannot reject H01, H02, and H04, while H03 is rejected. It is noticeable that the increase in primary balance and GDP growth by 1% causes a decrease in public debt by 0.812093% and 0.702646%, respectively. The negative impact of primary balance and GDP growth is supported by studies such as Pirtea et al. (2013), Dumitrescu (2014), and Swamy (2020). The increase in stock-flow adjustment by 1% causes an increase in public debt by 1.044284%. The R-squared indicator of the regression model indicates that the given variables describe more than 92% of the changes in the public debt variable. The probability of the regression model is statistically significant ( $p < 0.05$ ), which indicates that the model explains a significant amount of variance in the dependent variable.

## 5. CONCLUSION

The main goal of this study was to examine the impact of selected variables on Serbian public debt in the period from 2006 to 2023 by employing the OLS regression model. Our results of the coefficients assessment using the OLS approach indicate that the positive primary balance and GDP growth can affect the decrease in public debt. Therefore, we cannot reject H01 and H02. The results, which outline the importance of the impact of primary balance and GDP growth on the decrease of public debt, are in line with economic theory. Further, our results indicate that the interest rate has a negative coefficient and is not statistically significant, while stock-flow adjustment has a positive coefficient and a statistically significant influence on the public debt. Therefore, we reject H03, while H04 cannot be rejected. Considering that stock-flow adjustment is a synthetic indicator, the analysis of its composition deserves special attention in the future. The regression is significant, and the signs of the main explanatory variables are those that are

expected. This study provides an empirical basis for a better understanding of the dynamics of public debt and its main drivers and can be significant for policymakers in defining activities aimed at maintaining the stability of public debt. The research conducted has certain limitations since the analysis was carried out in one country and covered a rather short period of time. The author's suggestion for future research is the use of a larger number of countries that will be included in panel regression analysis, on the basis of which it could be concluded about the influence of the most important factors on the level of public debt in crisis conditions.

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**Nerma Čolaković-Prguda**

Associate professor, Faculty of Law,  
 University of Džemal Bijedić  
 Mostar, Bosnia and Herzegovina

e-mail: nerma@unmo.ba

**Irma Đideliija Čolaković**

Assistant professor, Faculty of Economics,  
 University of Džemal Bijedić  
 Mostar, Bosnia and Herzegovina

e-mail: irma.djideliija@unmo.ba

## **RURAL TOURISM IN FEDERATION OF BOSNIA AND HERZEGOVINA – CURRENT SITUATION AND PERSPECTIVES**

**Abstract:** Rural tourism stands out as a specific form of tourism. The rural search for peace, rest and recreation is a growing trend at regional, national, European and international levels. It can be said that rural tourism represents a relatively new tourist activity that aims to return people to traditional values and the natural environment.

This type of tourism produces numerous positive macroeconomic effects. These are, first of all: the development of underdeveloped areas, the employment of a larger number of household members, the placement of home-made products and agricultural products, and development of non-agricultural activities.

Development of rural tourism, in addition to contributing to the economic empowerment of the rural population, also contributes to the strengthening of local and regional economies, as well as the overall economy.

The most important consequence of rural tourism development in Federation of Bosnia and Herzegovina is the progress of rural communities, the improvement of the socioeconomic status of the rural population so that they would rather choose to stay in their surroundings than to migrate to larger cities in the country or outside the country.

In FBiH, there are already a lot of guesthouses, rural households, camps, vineyard houses, mountain huts and ethnic villages that provide rural tourism services. However, there are also numerous difficulties faced by those who have decided to stay in their local community and develop it through the provision of tourist services.

In the paper, we will point out the current situation in the field of rural tourism in FBiH, the challenges it faces and possible perspectives and directions in the future.

**Keywords:** rural tourism, macroeconomic effects, Federation of Bosnia and Herzegovina, economic development.

### **1. INTRODUCTION**

Tourism has become a global phenomenon that has been developing more and more in recent times, taking on new forms. Bosnia and Herzegovina is a country with significant potential for development of tourism. Its geographical location, rich history, numerous natural and historical monuments, its culture, openness and proximity to the European Union have enabled more intensive development of tourism during the last decade. Rural tourism stands out as a specific form of tourism. Rural areas represent particularly sensitive zones for the preservation of natural resources and cultural-historical heritage. The development of rural tourism is a relatively new phenomenon compared to traditional rural economic activities.

In Federation of Bosnia and Herzegovina, the number of interesting and unknown destinations in rural areas on the slopes of beautiful mountains, in lowlands and fields, where people live in a traditional way, preserve customs and cherish natural beauty and timeless and timeless values, is growing. In addition to rural areas that offer a preserved natural environment and healthy nutrition, eco and ethnic tourism has been developed in Federation of Bosnia and Herzegovina with numerous tourist centers that offer a unique environment and tourist offer. The beauty of the landscape and the uniqueness give Bosnia and Herzegovina a competitive advantage. Tourism, we can surely say, is one of the activities in rural areas, which creates added value and which very quickly becomes part of economic and social processes.

Within this topic, it is important to mention sustainable tourism. According to the definition, it represents the long-term development of tourism that helps preserve natural, cultural and social resources and has a positive effect on the

economic development and well-being of individuals in a certain community. One of the forms of tourism for achieving sustainability in rural areas is definitely rural tourism.

## 2. LITERATURE REVIEW

Rural tourism is an important factor for development of rural areas and it also helps to preserve local identity, traditions and customs. According to the official definition of the European Commission, rural tourism is a collective term for the field of ethnic tourism, and it represents tourism in every rural area and all tourist activities that are carried out in that area.

Lane (1994) defines rural tourism as tourism that takes place in rural areas, characterized by low population density and open space, small settlements with less than 10,000 inhabitants and land use mainly for farms, forestry and natural areas. There are different definitions of rural tourism, from those that observe it through the prism of space and define it as 'tourism that takes place in a rural area', to those that include a wide range of activities and elements of a complete rural tourism product, such as recreation and activities in rural environment, enjoyment of the rural environment, enjoyment of nature and the beauty of the landscape, cultural tourism, tourism in rural households and so on. The term 'rural tourism' is used when rural culture is a key component of the product offered by the destination.

The World Tourism Organization (UN Tourism; UNWTO until 2023) considers rural tourism as a form of tourism that includes any tourist activity in rural areas, organized and managed by the local population relying on local tourist resources (natural, cultural, historical, human) and tourist facilities (guesthouses, farms etc.) (Gašić et al, 2015)

According to the definition of the Council of Europe, rural tourism is tourism in a rural area with all the activities that are carried out in that area, and the most important characteristics of this type of tourism are: peaceful environment, absence of noise, preserved environment, communication with the hosts, local food and familiarization with rural affairs. (Rajko, 2013)

The European Union defines rural tourism as "the provision of complete activities in small settlements where tourists are offered accommodation, food and other services by small businesses in order to fulfillment of their expectations through agricultural and domestic values" (EC, 1999).

Rural tourism, on the one hand, is considered as tourist activity that takes place in rural areas, and, on the other hand, is considered very limited to some specific forms of tourism, such as rural tourism (Oppermann, 1996) or agritourism (Flannigan et al., 2014).

According to Alexandrov (2005), "rural tourism promotes cultural diversity, preservation of national heritage, appreciation of the lifestyle and traditions of the indigenous population, and respect for their privacy and dignity."

Intangible and material cultural contents such as tradition, language, way of life or visual appearance of the area can create specific characteristics related to the attractiveness of the destination for tourists. The word „tradition“ is often associated with rural tourism, therefore there is a trend in rural tourism that focuses on the creation of various activities, such as visits to ethno-villages, theme parks and ethno-homes, participation in events and ethno-festivals, traditional dances or ceremonies (Yang, 2011).

These activities emphasize the unique character of rural areas. The creativity of activities in rural tourism leads to the creation of tourism in which seasonality disappears or is less important. The main focus of rural tourism was for a long time on the development of sustainability, however, modern rural tourism is characterized by two new trends: creativity and authenticity.

The most important motives that make tourism in rural areas interesting and acceptable are classified according to typology as:

- physical, such as relaxation,
- cultural, such as discovering new spaces,
- interpersonal, such as socialization and meeting new people,
- prestige, such as self-knowledge and self-actualization. (Ružić, 2012)

Rural tourism is the fastest growing segment of tourism, and that's why the tourism industry should take into account its impact on the environment, culture, society and economy.

## 3. RESULTS OF SECONDARY RESEARCH

In the continuation of the work, the presentation of the most significant secondary data in the tourism and rural tourism sector in FBiH and in general BiH for the pre-pandemic and pandemic period is given. This is the last period for which the requested data is available.

According to the data of the Federal Statistical Office and the EU4Business project in Bosnia and Herzegovina, the following trends are recorded in the tourism sector:

The tourism industry in Bosnia and Herzegovina has experienced significant growth in recent years in terms of the number of tourist arrivals and overnight stays. In 2019, the number of tourist arrivals reached 1,641,000, which is 25.6% more than in 2017. The number of tourist nights in 2019 was 3,371,000, which represents a growth of 25.9%.

This growth is the result of an almost 30% increase in the number of foreign tourist arrivals and a 26.4% increase in the number of overnight stays by foreign tourists. Arrivals and overnight stays of domestic tourists were slightly lower, but still at a high level. In the period 2017–2019, the number of domestic tourist arrivals increased by 15.4%, and the number of overnight stays by 24.6%. Significant growth in tourist arrivals and overnight stays was recorded in FBiH, RS and BD.

Europe is the main market for BiH tourism. In 2019, European tourists accounted for 65% of all tourist arrivals and 68% of the total number of overnight stays. Tourists from Asia are the second largest market, responsible for 29% of the total number of international tourist arrivals and 26% of overnight stays in 2019, which was also the case in the period 2015–2019, when the highest growth rate was achieved. In terms of tourist arrivals (326%) and tourist overnight stays (291%) in 2019, visitors from Asia made up a larger percentage of the total number of international arrivals in BiH. However, the situation varies between entities and BD. While foreign tourists accounted for 79% of arrivals in FBiH, in RS and BD foreign tourists accounted for 55% and 57% of arrivals in 2019, respectively. Differences are also present among tourist destinations. Nevertheless, the results indicate that FBiH is predominantly oriented towards foreign markets, while in RS and BD the domestic market holds a significant share.

According to the number of tourist arrivals for 2019, the first ten countries of origin are: Croatia, China, Serbia, Turkey, Slovenia, Saudi Arabia, Germany, Italy, South Korea and Poland, which together make up 61.1% of the total number of tourist arrivals for that year. Their individual shares have increased by 3% since 2017. However, there were also significant changes in the ranking of these countries due to a large increase in the number of tourists from China (+223%) and Saudi Arabia (+170%).

In the FBiH, the structure of tourist arrivals is more diverse than in the RS. In the FBiH, the following are among the top ten countries of origin: Croatia, China, Saudi Arabia, Turkey, Germany, Slovenia, Italy, South Korea, Serbia and other Asian countries. In the RS, Serbia, Croatia and Slovenia are far ahead of the other countries of origin, followed by Turkey, Germany, China, Montenegro, Austria, Italy and Poland, with much smaller shares in the total number of tourist arrivals and overnight stays compared to the first three countries.

The COVID-19 pandemic stopped positive tourism trends in BiH. Since June 2020, with the easing of measures and the end of movement restrictions, there are signs of a slow recovery. But the pandemic still left significant consequences. In 2020 (January - September), the number of tourist arrivals and overnight stays was at the level of 25.7% and 28.9%, respectively, compared to 2019. The decline in the RS was smaller than in the FBiH. The main reason may lie in the fact that in recent years the RS had a higher percentage of domestic tourists (44%, compared to only 19% in FBiH), as well as the fact that 54% of foreign tourist arrivals in 2019 came from the main tourist markets for the RS, which are concentrated in the region (Serbia, Croatia and Slovenia).

The number of accommodation facilities in the FBiH has grown significantly (by 56.1%) over the past five years (2015–2019). A total of 756 accommodation facilities were registered in BiH in 2019, of which 71% were located in FBiH. Last year, the number of accommodation facilities decreased by 30% in the West Herzegovina Canton, by 28.8% in the Herzegovina-Neretva Canton and by 21.8% in the Una-Sana Canton. For those who provide accommodation in rural tourism in BiH, 50% have recently increased their capacities.

The total number of rooms in BiH in 2019 was 18,740 (of which 71.6% in FBiH, 27% in RS and 1.4% in BD). In the period of five years (2015–2019), there was an increase in accommodation capacity in both entities (by 43.8% in the FBiH and by 7.9% in the RS).

According to statements from a series of analyzes and reports, such as the European Commission Report for Bosnia and Herzegovina for 2020, the Report on the Ease of Doing Business in BiH for 2020 published by the World Bank and the Business Guide for Bosnia and Herzegovina for companies from the USA - Doing Business 2019 for BiH, BiH is described as a place with numerous obstacles and a relatively unfavorable business environment. When we talk about sustainable development, BiH is in the initial phase and the further integration of sustainability principles into tourism will depend on the state's ability to prepare new and effective sustainability policies, which includes economic policies (e.g. eco-taxes, user fees, financial incentives and transferable building permits), regulatory policies (quotas and zoning) and institutional instruments (eg eco-labels).

According to WEF's Tourism Competitiveness Index for 2019, BiH lags behind selected countries of the Western Balkans in almost all indicators except for average income per arrival, where it ranks second in the region. Only North Macedonia is worse positioned than Bosnia and Herzegovina. The major limitations that hinder the competitiveness of BiH tourism are that the authorities do not sufficiently support the development of tourism, which is the low visibility of BiH as a tourist destination, the poor quality of tourist products, services and tourist infrastructure, and the lack of qualified and professional workforce. All these factors are recognized as critically important for the successful development of tourism. These limitations should be solved primarily in order to increase the competitiveness of BiH tourism on international markets.

When it comes to rural tourism in FBiH, no official statistics are available for basic tourism indicators, but all data in this sub-sector of tourism are based on surveys conducted by researchers. According to research by Ljutić (2013), the following advantages and disadvantages, as well as chances and dangers specifically in rural tourism are defined in Bosnia and Herzegovina.

### Advantages

- Rich in natural resources
- Demonstrated interest among the rural population to work in agro-tourism
- Favorable conditions for the development of agriculture, especially livestock, fruit production due to rich orchards, as well as the development of agro-tourism
- Protected environment
- Diverse and abundant quantities of medicinal herbs and forest fruits
- Underdeveloped industry
  - Rich cultural and historical heritage. Some sights are protected by UNESCO
- The existence of hunting grounds and an abundance of game and fish
- The existence of traditional crafts
- The interest of local authorities in establishing any type of cooperation
- The willingness of the local population and authorities to implement development projects
- Favorable geostrategic position
  - Traditional hospitality
  - existence of national parks
  - Unspoiled and beautiful mountain areas
- The region borders Serbia and Montenegro and connects these countries with the Adriatic Sea
  - Quality agricultural products
- Available prices of goods and services
- Good IT network coverage
- Well-organized health care
- One of the safest regions in BiH
- The existence of developed sports, cultural and artistic associations
- Tradition and experience in organizing fairs and other events

### Weaknesses

- High unemployment rate
- Large population migrations, especially young people, to larger cities
- Unfavorable relationship between the old and young population
- The inability of the rural population to invest in the development of rural tourism in order to achieve the minimum international standard in rural tourism
- Rural households are not categorized
- Lack of tourist maps and road signs
- Lack of information points in all cities in the region
- Lack of physical infrastructure
- Lack of legislation in tourism in Bosnia and Herzegovina
- Some areas still have minefields
- Abandoned farms and land
- farmers have no experience in organization, management and marketing
- Insufficient training and training on starting a new business (lack of a quality business plan)
- Low level of awareness about the importance of environmental protection
- Unequal distribution of resources by local communities
- Neglect of tradition, natural, cultural and historical heritage
- Lack of a strategy related to the distribution of donor funds
- Insufficient labeling of tourist attractions
- Insufficient quantities of traditionally produced products (households often produce only for their own needs)
- Bad roads and failure to reflect them
- Insufficient promotion, marking and "exploitation" of cultural and historical monuments
- bad image of Bosnia and Herzegovina in the world
- Weak communication between municipalities and cantons
- Absence of the Ministry of Tourism at the state level
- Weak (bad) work of cantonal and municipal tourist boards
- Weak promotion of tourist potential in Bosnia and Herzegovina and abroad
- Pre-war infrastructure that has not yet been restored
- Increasing distance between the village and the household engaged in rural tourism
- unfavorable length of the tourist season (only 6 months)
- Lack of other tourist attractions such as entertainment facilities
- Lack of regular transport in rural areas
- Absence of making original tourist souvenirs
- Absence of money exchange offices

### Possibilities

- Connecting urban and rural areas
- Agriculture and the development of rural areas are a priority for overall development
- Increased interest of farmers in involvement in agro-tourism and use of additional space in the household
- Confirmation of the territory
- Great natural resources and domestic products
- Establishment of eco and ethno villages
- Increased interest in food production without the use of additives
- Revival of cultural events
- Opening and expanding the capacity of cultural and historical heritage
- Increase interest among tourists in hunting and fishing
- Provide funds and other donations for the development of rural tourism
- Use the existence of local and international and non-governmental organizations in the development of rural tourism
- International donors are interested in the implementation of the program for the development of rural tourism
- Increased interest of women in education and the importance of their role in the development of rural tourism
- Possibilities for the revival of old traditional customs, games and folklore of the Bosnian countryside • Create an internal categorization and standardization of households engaged in agro-tourism
- Create tourist packages with clear offers for 3-4 days of stay

### Potential hazards

- Continued emigration of the population from rural to urban areas
- Strong influence of negative policies
- Reduced international aid
- General economic crisis
- General political instability after the reduction of foreign investment
- Continuous isolation of municipalities from each other
- Limited fund for the development of rural tourism
- Grey economy
- Lack of any measures to help in the development of rural tourism
- Lack of financing of rural areas by relevant institutions
- Inadequate laws in the field of environmental protection, agro-tourism, agriculture and rural tourism development
- Poor maintenance of roads in rural areas during winter
- Disappearance of traditional crafts
- The inability of local authorities to help finance projects for the development of rural tourism
- Incomplete privatization process
- Lack of any measures to help rural areas
- Complicated procedures for obtaining funds

## **4. DISCUSSION**

According to the previously presented statistical data on the tourism sector and the completed SWOT matrix, it is possible to determine the following recommendations and perspectives for this important sector of the BiH economy, which are in accordance with the EU4business project (the recommendations mostly refer to the needs of state intervention, which is also common for small and countries in the development of the tourism sector such as Bosnia and Herzegovina):

1. Strengthening competitiveness through better management, regulation, provision of comparable data and establishment of cooperation and dialogue with actors in the tourism sector

The future success of tourism largely depends on the ability of the authorities to establish an efficient administrative and institutional structure that will ensure the successful development, promotion and regulation of the sector. The introduction of management at multiple levels of government or horizontal cooperation between all competent ministries and public institutions and the strengthening of cooperation and dialogue with the private sector and NGOs are necessary elements for effective management of tourism development. In addition, a clear and firm commitment of the authorities to the development of tourism and the ability of public officials to lead and manage the preparation and implementation of strategies in the field of tourism are necessary factors that will ensure the full implementation of priority policy measures.

2. Greater visibility of BiH and FBiH as tourist destinations on the global tourist market

The public sector traditionally plays a leading role in destination marketing and promotional activities due to the fragmented nature of the sector and the fact that tourism companies are mostly small, so individual companies can hardly break through independently and attract visitors from distant markets. That is why the development and promotion of the image/brand of the country and the range of products that meet the needs of

the market are of vital importance for the competitiveness of the tourism sector. It is about raising awareness and attracting interest, prolonging the stay and increasing the spending of visitors, and encouraging repeat visits and referrals. Defining and articulating a country's recognizable brand is the key to effective marketing and is the basis for crafting promotional messages and developing products that will deliver on brand promises. A brand, which is much more than a simple logo or slogan, succinctly shows the complete identity of a tourist destination, its essence and permanent characteristics. In addition, governments are now looking for ways to take advantage of the digital transformation in tourism.

3. Encouraging the quality of tourist products and services

Recent trends indicate that countries continue to invest in existing tourism standards and quality systems. Governments are turning to official certification systems to indicate the quality of facilities and services in this context. These standards offer the authorities tools that can help local businesses to improve the quality of their products and services and implement a broader policy aimed at improving the tourist offer, for example in terms of easier access for individual businesses. The availability and quality of accommodation facilities is one of the key success factors in tourism. That is why it is important to design a framework that will stimulate the availability and quality of all types of accommodation within the economy. Providing incentives for investment in private accommodation capacities, especially for SMEs, could significantly increase the availability of various types of high-quality accommodation adapted to the needs of tourists. An efficient framework of quality standards for accommodation capacities, with systematic categorization, is necessary to maintain the quality of accommodation at a consistent level. In addition, the quality of public services and tourist infrastructure is important for the competitiveness of tourism.

4. Stimulating new tourist products and experiences, as well as innovations in tourism

Stimulating the development of unique, authentic tourist products is one of the important functions of the government in the process of attracting new types of visitors and accessing completely new markets throughout the year. The development of tourist products and the diversification of the tourist offer are means that contribute to economic growth, regional development, the extension of the tourist season and serving new markets. It is obvious that at the core of a successful tourism sector lies a high-quality and diversified tourism product that reflects the landscapes, heritage and other advantages of the country, and is formed depending on and based on demand. This is a key measure to support the recovery of the tourism sector after the COVID-19 pandemic, which would simultaneously create preconditions for long-term sustainable and competitive tourism development. In the medium-term perspective, the development of tourist products will require an integral approach, with support for investments in public services, traffic and tourist infrastructure, as well as providing support to MSMEs by introducing financing and lending measures, economic incentives, allocating land for use, determining locations, direct promotion, providing advisory and other assistance to investors and incentives for innovations in tourism.

5. Building employee competencies and employment in tourism

In many countries, education and professional development in the field of tourism represent one of the basic areas of government intervention, which ensures a sufficient number of qualified and competent workers, who can apply and maintain high quality standards. Policy measures aim to direct as many (mostly young) people as possible to formal education and vocational training programs in the field of tourism in order to meet the demand for skilled labor and increase the level of professionalism in the sector. These measures are aimed at creating career opportunities and building skills and competencies that will benefit both individuals and employers in the long term.

6. Improving access to destinations

Accessibility of destinations is one of the key success factors in the development of tourism. It refers to the transport connectivity of the country and the quality of the transport network within the country. The visa regime and easy border crossing are also important aspects that contribute to international tourism. Visa formalities require time, effort and expense, which can affect tourists' decisions and global tourist travel patterns. Lengthy and unpleasant procedures at border crossings affect the first impression that tourists get about the destination and make it difficult for tourists to flow through the region.

7. Encouraging the development of sustainable tourism and business

Many governments have recently made strides by integrating sustainability principles into their tourism policies and related strategies. However, the implementation of these strategies and the realization of adopted measures and common aspirations is a constant challenge. In this sense, the participation of local communities is increasingly considered an important factor in the development of an inclusive and sustainable tourism sector. There is a growing interest in allowing local communities to keep more of the benefits of tourism for themselves. The sustainability of tourism development and tourism activities can be regulated by regulations, but sustainability can also be worked on by other means, such as, for example, financial incentives, labels, giving guidelines and capacity building.

## 5. CONCLUSION

Rural tourism is very important factor for development of rural areas and it also helps to preserve local identity, traditions and customs. It is the fastest growing segment of tourism, and that's why the tourism industry should take into account its impact on the environment, culture, society and economy. In Federation of Bosnia and Herzegovina, the number of interesting and unknown destinations in rural areas is growing. In addition to rural areas that offer a preserved natural environment and healthy nutrition, eco and ethnic tourism has been developed with numerous tourist centers that offer a unique environment and tourist offer. When it comes to rural tourism in FBiH, as a special type of tourism, no official statistics are available for basic tourism indicators, but all data in this sub-sector of tourism are based on surveys conducted by researchers. We defined, within this paper, some advantages and disadvantages, as well as chances and dangers specifically in rural tourism in Bosnia and Herzegovina.

According to the presented statistical data on the tourism sector and the completed SWOT matrix, we have determined some recommendations and perspectives for this important sector of the BiH economy, which are in accordance with the EU4business project:

- Strengthening competitiveness through better management, regulation, provision of comparable data and establishment of cooperation and dialogue with actors in the tourism sector
- Greater visibility of BiH and FBiH as tourist destinations on the global tourist market
- Encouraging the quality of tourist products and services
- Stimulating new tourist products and experiences, as well as innovations in tourism
- Building employee competencies and employment in tourism
- Improving access to destinations
- Encouraging the development of sustainable tourism and business.

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# **Session**

# **3**



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## RADOJKO LUKIC

Faculty of Economics University of Belgrade  
 E-mail: radojko.lukic@ekof.bg.ac.rs

# ANALYSIS OF TRADE MARGINS IN SERBIA

**Abstract:** Research into the size and structure of the margin in trade is a continuous, relevant, and complex issue. Margin is one of the significant performance indicators of trade. In this study, starting from that, the size and structure of the trade margin of the European Union are analyzed, with special reference to Serbia. The research results show the following: In the trade of the European Union, the margin rate ranges from 7.02% (Luxembourg) to 22.05% (Ireland). In the leading countries of the European Union, the trade margin rate is Germany at 15.15%, France at 16.48%, and Italy at 13.48%. In the countries in the region of Serbia, the trade margin rate is Croatia 13.22% and Slovenia 13.15%. The trade margin rate in Bosnia and Herzegovina is 11.35%. In Albania, the trade margin rate is 11.66%. In Serbia, the trade margin rate is 15.79. The trade margin rate in Serbia is higher than in Croatia and Slovenia. In the trade of Serbia, the sales margin rate in the period 2013-2022. ranged from 13.51% (2014) to 20.45% (2013). The average sales margin rate in Serbian trade is 14.82%. It is lower in 2022 compared to 2021. The rate of margin from stocks in Serbian trade ranges from 69.52% (2015) to 122.74% (2013). In 2022, compared to 2021, the margin rate from inventory is lower. The average rate of margin from stocks in Serbian trade is 79.97%. In Serbian trade, there is a strong correlation between margin and sales, the purchase value of realized goods, operating expenses, salary of employees, net profit and inventory, and that at the level of statistical knowledge. There is a strong correlation between the rate of margin on sales the rate of margin on inventory and the rate of operating costs of trade in Serbia. The target margin of trade in Serbia can be achieved by effective control of sales, purchase value of realized goods, operating costs, employee wages, net profit, and inventory. The purpose of this is to improve the competitive position and digitize the entire business.

**Keywords:** sales, purchase value of realized goods, margin, operating costs, net profit

**JEL classification :** C61, M41, L81

## 1. INTRODUCTION

By the nature of things, the margin is one of the most important performance indicators of trade. In terms of structure, it serves to cover operational costs and generate a certain profit for the needs of trade growth and development. It is formed freely and in a controlled manner. The size of the trade margin, regardless of the way it is formed, should be large enough to suit producers, traders, and consumers. Bearing in mind the importance of the margin in trade, in this study, in addition to the theoretical and methodological analysis, the determinants of the size and structure of the trade margin of the US and the European Union are empirically investigated, with special reference to Serbia. The aim and purpose of this is to specifically point out what measures should be taken to achieve the target size and structure of the trade margin in Serbia. The research hypothesis in this study is based on the fact that continuous analysis and control of the size and structure of the margin is a prerequisite for achieving the target performance in trade. Consequently, the research methodology based on ratio analysis, statistical analysis, and DEA analysis was adopted. The necessary empirical data were collected from various

relevant sources (Internet sites, Eurostat, and the Agency for Economic Registers of the Republic of Serbia). The composition of the study is such that, in addition to the introduction and conclusion, it includes a literature review and theoretical, methodological, and empirical dimensions of the margin problem in trade.

## 2. REVIEW OF THE LITERATURE

In the literature, the gross margin of trade is from different angles. By the nature of things, significant attention has been devoted to the theoretical and methodological basis of gross margin analysis (Berman et al., 2018; Levy et al., 2019; Lukić, 2011, 2020). The size of the gross margin of trade in individual countries is different, as indicated by numerous empirical studies ( O'Riordan, 1993; Potjes & Thurik, 1993 ). It is also different for individual trade sectors (Patrick D'Arcy et al., 2012). Special attention in the literature is devoted to the empirical analysis of the impact of inventory on the size of the gross margin in retail (Gaur et al., 2014 ). The influence of margin on the performance of trading companies in Serbia has been investigated in the literature (Lukić, 2017). The size and structure of operating costs as a component of the gross trade margin in Serbia were also analyzed (Baralić, 1982; Lukić, 2021; Lovreta & Petković, 2021). Transportation and storage costs significantly affect the size of the gross margin in trade. The size and structure of the margin are specific for certain economic branches, for example in the oil industry ( Nowakowski & Karasiewicz, 2016). Competition is a significant factor in the size of trade margins ( Carter, 2019). In the literature, considerable attention has been paid to price and margin control of food supply chains in the European Union (Baltussen et al., 2019). Business concentration and margin increase in the retail sector were especially analyzed (Hambur & Cava 2018). In the literature, considerable attention is paid to gross margin, gross profit, and price elasticity of demand (Vance, 2021). Generally speaking, all relevant aspects of trade margin have been analyzed in the literature. At the center of attention in the literature is the problem of determinants of the size and structure of the margin in trade ( Ailawadi & Harlam, 2004).

## 3. THEORETICAL AND METHODOLOGICAL ANALYSIS OF THE MARGIN IN TRADE

Margin is a very important indicator of trading performance (Berman et al., 2018; Levy et al., 2019). In terms of structure, it serves to cover operating costs and generate a certain profit for the needs of growth, development, and improvement of trade operations. The size of the trade margin should be such that it can cover all operating costs make a certain profit, and satisfy everyone in the value chain (suppliers, traders, and customers). Determinants of the size of the margin are sales, purchase value of goods, dependent procurement costs, energy costs, operating costs, employee wages, profit, assortment, competition, digitization of the entire business, government policy, and others. Effective control of these and other factors can influence the achievement of the target margin. In the methodological sense, that is to say, the margin rate is determined as the difference between the sale and purchase value of the goods divided by sales times 100, i.e.:  $\text{Gross margin percentage} = (\text{Sales} - \text{Cost of goods sold}) / \text{Sales} \times 100$ . It shows how much, for example, \$1 of sales generates \$margin. In other words, it shows how much % of the margin is realized on 100% of sales. Margin is very often expressed as a % of investment in inventory. The rate of margin from investments in inventory is determined by dividing the margin by inventory times 100, that is:  $\text{Gross margin return on investment} = \text{Gross margin} / \text{Cost of average inventory} \times 100$ . It shows how much, for example, \$ of margin is realized on \$ 1 of inventory investment. In other words, it shows how much % margin is realized on 100% investment in inventory. The margin rate is different for certain sectors, but markets do not. As a rule, it is lower in wholesale trade than in retail trade. For the sake of illustration, Table 1 shows the margin rate of wholesale trade, retail trade, and electronic trade.

**Table 1:** Sectoral analysis of the margin rate

Wholesale Industry Profitability Ratios	2 Q 2023	1 Q 2023	4 Q 2022	3 Q 2022	2 Q 2022
	2023	2023	2022	2022	2022
Gross Margin	24.91 %	18.87 %	23.12 %	21.55 %	21.87 %
Gross Margin Annual (TTM)	24.85 %	18.57 %	22.24 %	21.92 %	22.18 %
Gross Margin Ranking	#89	# 99	#88	# 96	# 96
EBITDA Margin	8.17 %	4.11 %	8.01 %	4.3%	5.92 %

EBITDA Margin Annual (TTM)	6.63 %	5.13 %	6.12 %	5.12 %	5.7 %
EBITDA Margin Ranking	#82	# 92	# 75	# 94	# 96
Operating Margin	4.93 %	4.01 %	6.82 %	3.11 %	4.35 %
Annual Operating Margin (TTM)	5.02 %	4.19 %	4.65 %	3.9%	4.27 %
Operating Margin Ranking	#88	#85	# 75	# 90	# 95
Pre-Tax Margin	6.04 %	3.18 %	6.85 %	1.67 %	4.12 %
Pre-Tax Margin Annual (TTM)	4.44 %	3.73 %	3.98 %	3.14 %	3.71 %
Pre-Tax Margin Ranking	#70	#80	# 58	#88	#89
Net Margin	4.49 %	2.36 %	5.46 %	1.05 %	3.18 %
Net Margin Annual (TTM)	3.35 %	2.83 %	3.04 %	2.22 %	2.7 %
Net Margin Ranking	# 75	#80	# 59	#85	#

Source: [https://csimarket.com/Industry/industry\\_Profitability\\_Ratios.php?ind=1310&hist=1](https://csimarket.com/Industry/industry_Profitability_Ratios.php?ind=1310&hist=1)

Retail Sector Profitability Ratios	2 Q 2023	1 Q 2023	4 Q 2022	3 Q 2022	2 Q 2022
	2023	2023	2022	2022	2022
Gross Margin	25.02 %	23.36 %	24.45 %	23.63 %	23.52 %
Gross Margin Annual (TTM)	25.08 %	23.51 %	24.27 %	23.36 %	23.49 %
Gross Margin Ranking	# 13	# 12	# 13	# 13	# 13
EBITDA Margin	6.8 %	6.42 %	6.56 %	3.7 %	5.51 %
EBITDA Margin Annual (TTM)	6.52 %	6.17 %	5.8 %	5.77 %	6.59 %
EBITDA Margin Ranking	# 12	# 12	# 12	# 13	# 13
Operating Margin	4.94 %	4.47 %	3.49 %	2.62 %	4.63 %
Annual Operating Margin (TTM)	4.12 %	4.23 %	3.94 %	3.63 %	4.22 %
Operating Margin Ranking	# 12	# 12	# 13	# 13	# 13
Pre-Tax Margin	5.01 %	4.07 %	2.87 %	2.03 %	3.77 %
Pre-Tax Margin Annual (TTM)	3.72 %	3.72 %	3.09 %	3.27 %	3.99 %
Pre-Tax Margin Ranking	# 11	# 12	# 11	# 13	# 13
Net Margin	3.88 %	3.11 %	2.17 %	1.43 %	2.93 %
Net Margin Annual (TTM)	2.83 %	2.85 %	2.3%	2.52 %	3.09 %
Net Margin Ranking	# 11	# 12	# 11	# 13	# 13

Source: [https://csimarket.com/Industry/industry\\_Profitability\\_Ratios.php?s=1300](https://csimarket.com/Industry/industry_Profitability_Ratios.php?s=1300)

Internet, Mail Order & Online Shops Industry Profitability Ratios	1 Q 2023	4 Q 2022	3 Q 2022	2 Q 2022	Q1 2022
	2023	2022	2022	2022	2022
Gross Margin	43.75 %	38.08 %	41.5 %	41.63 %	39.47 %
Gross Margin Annual (TTM)	41.85 %	39.38 %	39.84 %	39.38 %	38.95 %
Gross Margin Ranking	# 58	#70	# 63	# 62	# 63
EBITDA Margin	11.21 %	12.27 %	1.43 %	-	3.27 %
EBITDA Margin Annual (TTM)	8.15 %	5.7 %	7.88 %	8.83 %	10.88 %
EBITDA Margin Ranking	# 68	#55	# 101	# 104	# 97
Operating Margin	3.32 %	-	-	2.5%	2.54 %
Annual Operating Margin (TTM)	1.82 %	0.9%	1.37 %	2.29 %	3.11 %
Operating Margin Ranking	# 91	# 98	# 97	# 101	# 94

Pre-Tax Margin	2.77 %	-	0.21 %	-	-
Pre-Tax Margin Annual (TTM)	0.11 %	-	1.18 %	1.92 %	3.93 %
Pre-Tax Margin Ranking	#87	# 94	# 94	# 101	# 97
Net Margin	2.03 %	-	0.02 %	-	-
Net Margin Annual (TTM)	0.13 %	-	1.27 %	1.84 %	3.65 %
Net Margin Ranking	#84	# 95	# 95	# 100	# 97

Source: [https://csimarket.com/Industry/industry\\_Profitability\\_Ratios.php?ind=1302](https://csimarket.com/Industry/industry_Profitability_Ratios.php?ind=1302)

In this specific case, therefore, the margin rate is lower in wholesale trade than in retail trade. With e-commerce, the margin rate is significantly higher than with traditional wholesale and retail trade. The margin rate is different for individual product categories. As a rule, it is lower in food products than in non-food products. For illustration purposes, Table 2 shows the margin of selective sectors (ie, product categories) in the US

**Table 2:** Margins by Sectors (US), January 2023

Industry Name	Gross Margin	Net Margin
Apparel	51.84%	5.07%
Beverage (Alcoholic)	44.42%	5.76%
Beverage (Soft)	53.55%	14.60%
Drugs (Pharmaceutical)	67.02%	18.35%
Electronics (Consumer & Office)	32.29%	0.54%
Electronics (General)	27.35%	6.32%
Hotel/Gaming	56.29%	1.10%
Insurance (General)	40.00%	15.21%
Insurance (Life)	25.99%	6.07%
Food Wholesalers	14.39%	1.09%
Oil/Gas Distribution	23.60%	2.08%
Restaurant/Dining	30.07%	9.28%
Retail (Automotive)	21.04%	4.07%
Retail (Building Supply)	34.51%	8.67%
Retail (Distributors)	31.30%	7.30%
Retail (General)	23.25%	2.35%
Retail (Grocery and Food)	24.71%	1.96%
Retail (Online)	42.78%	0.64%
Retail (Special Lines)	29.90%	3.86%
Transportation	21.94%	6.99%
Transportation (Railroads)	52.26%	27.65%
Utilities (General)	36.67%	12.68%

Note: Last Updated in January 2023 By Aswath Damodaran

Source: [https://pages.stern.nyu.edu/~adamodar/New\\_Home\\_Page/datafile/margin.html](https://pages.stern.nyu.edu/~adamodar/New_Home_Page/datafile/margin.html)

In the displayed table, as can be seen, the margin rate ranges from 14.39% ( Food Wholesalers ) to 67.02% ( Drugs (Pharmaceutical) ). Generally speaking, the margin rate is lower for food (fast-moving goods) than for other product categories. (slower moving goods). There are two margin management strategies in trade: the strategy of small margin higher sales, and the strategy of higher small lower sales. The choice of margin management strategy in trade depends, among other things, on the product category. The concept of managing product categories is one of the important levers for improving the performance of traders.

**The size of the trade margin in the US.** The size of the trade margin is different for individual countries due to the different influences of key factors. In this study, we will illustrate this through the example of trade in the US, the European Union, and Serbia. Table 3 shows the margin rate in the US by trade sector and product category.

**Table 3:** Gross margin in the US

	2021	2020	2019	2018	2017
Wholesale trade-durable goods	26.6%	24.4%	24.4%	24.7%	25.2%
Wholesale trade-non-durable goods	21.7%	18.1%	17.6%	17.1%	18.1%
General Merchandise Stores	31.6%	30.5%	32.7%	30.6%	31.6%
Food Stores	28%	28.1%	27.1%	27.6%	26.7%
Apparel And Accessory Stores	39.8%	31.5%	34.5%	35.5%	36.9%
Home Furniture, Furnishings, And Equipment	47.9%	37.3%	36.3%	35.8%	36.6%
Miscellaneous Stores	35.4%	31.8%	30.5%	33.6%	32.3%

<https://www.readyratios.com/sec/ratio/gross-margin/>

The data in the given table shows that the margin rate in 2021 in the US was for wholesale - durable goods at 26.6%, wholesale - non-durable goods at 21.7%, food stores at 28%, home furniture, and equipment stores at 47.9%, etc. Therefore, in the US, the margin at the grocery store is significantly lower than at the others. The very nature of the product category, among other things, determines the size of the margin. In the US, the trade margin is higher than in the countries of the European Union and Serbia.

**Size of trade margin in Russia.** To compare the size of the trade margin in the US and Russia, we will analyze the size of the trade margin in Russia. Table 4 shows the size of the margin of wholesale and retail trade in Russia.

**Table 4:** Margin of trade in Russia

	Wholesale and retail trade in motor vehicles and repairs, %		Wholesale trade, except motor vehicles and repairs, %		Retail trade, except for motor vehicles and repairs, %	
	2019	2020	2019	2020	2019	2020
Gross profit (margin)	8.93	10.19	18.53	16.49	24.80	24.87
Gain	1.81	3.03	6.12	4.43	2.86	3.48

**Note:** Author's calculation

**Source:** Trade in Russia 2021. Federal State Statistics Service (Rosstat), Statistical Collection, Moscow 2021.

In Russia, the margin of wholesale trade, excluding motor vehicles and direct sales in 2020, was 16.49%. In retail trade, except for motor vehicles, the margin was 24.87%. The trade margin in Russia is therefore lower than in the US

**The size of the trade margin in the European Union.** The trade margin of the trade of the European Union is calculated as the difference between the turnover and the total supply of goods and services. By the nature of things, the size of the trade margin for individual European Union member countries is different. Table 5 and Picture 1 show the trade margin rate in the European Union for 2020. Descriptive statistics of the observed statistical variables of European Union trade are shown in Table 6.

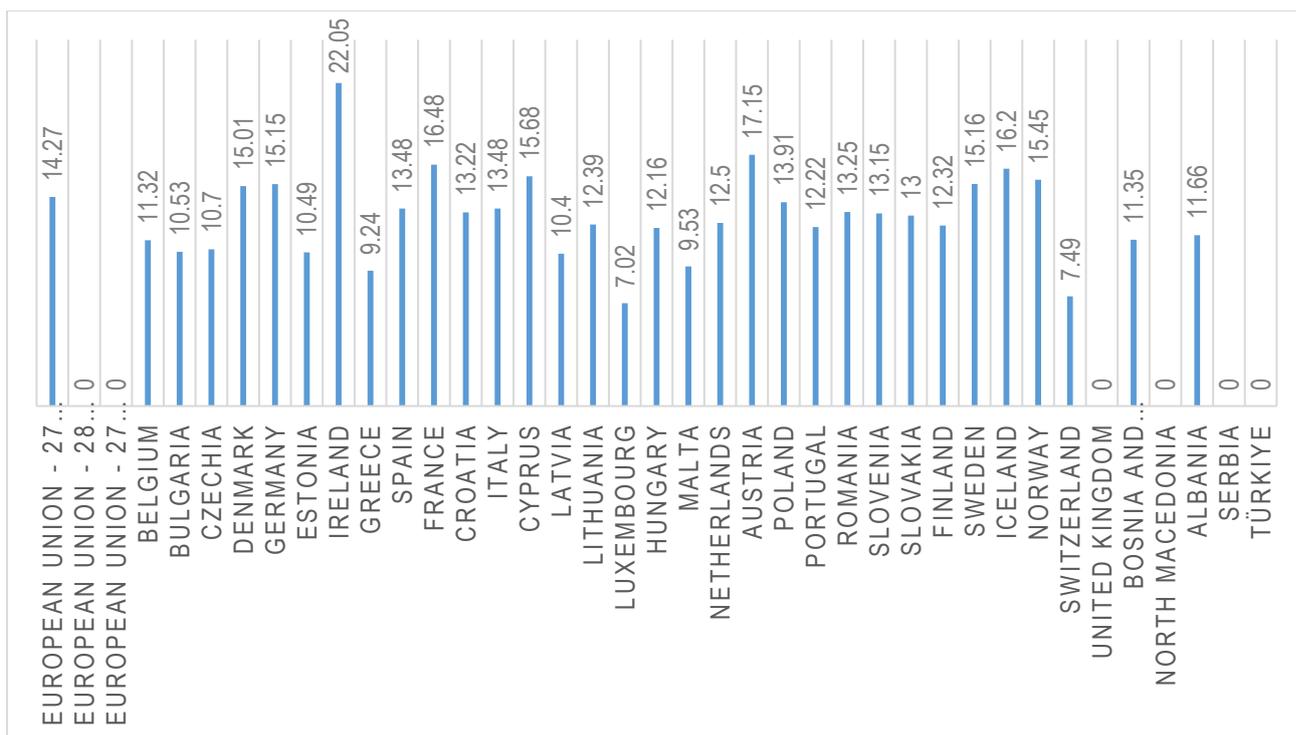
**Table 5:** Gross margin trade in the European Union 2020

Wholesale and retail trade; repair of motor vehicles and motorcycles	Turnover or gross premiums written - million euros	Total purchases of goods and services - million euros	Gross margin – one million euros	gross margin, %
European Union - 27 countries (from 2020)	8,745,002.6	7,497,188.1	1,247,814.50	14.27
European Union - 28 countries (2013-2020)	:	:	:	:
European Union - 27 countries (2007-2013)	:	:	:	:
Belgium	472,683.6	419,183.7	53,499.90	11.32
Bulgaria	67,379.3	60,285.5	7,093.80	10.53

Czechia	159,941.2	142,830.1	17,111.10	10.70
Denmark	187,951.8	159,740.2	28,211.60	15.01
Germany	2,119,183.7	1,798,232.0	320,951.70	15.15
Estonia	26,936.4	24,111.0	2,825.40	10.49
Ireland	183,495.2	143,036.5	40,458.70	22.05
Greece	106,976.0	97,093.2	9,882.80	9.24
Spain	726,551.3	628,641.2	97,910.10	13.48
France	1,331,409.7	1,112,035.6	219,374.10	16.48
Croatia	35,379.7	30,703.3	4,676.40	13.22
Italy	945,227.6	817,787.0	127,440.60	13.48
Cyprus	12,673.7	10,686.4	1,987.30	15.68
Latvia	28,555.4	25,584.7	2,970.70	10.40
Lithuania	41,122.8	36,027.3	5,095.50	12.39
Luxembourg	74,336.3	69,114.4	5,221.90	7.02
Hungary	104,756.1	92,013.8	12,742.30	12.16
Malta	8,603.8	7,784.1	819.70	9.53
Netherlands	691,536.8	605,115.3	86,421.50	12.50
Austria	249,457.7	206,663.7	42,794.00	17.15
Poland	421,418.6	362,803.7	58,614.90	13.91
Portugal	140,636.0	123,456.2	17,179.80	12.22
Romania	128,164.3	111,177.6	16,986.70	13.25
Slovenia	34,082.1	29,601.4	4,480.70	13.15
Slovakia	58,303.8	50,723.6	7,580.20	13.00
Finland	118,489.1	103,888.8	14,600.30	12.32
Sweden	269,750.9	228,867.9	40,883.00	15.16
Iceland	9,140.9	7,660.2	1,480.70	16.20
Norway	179,149.5	151,474.8	27,674.70	15.45
Switzerland	1,186,803.2	1,097,966.8	88,836.40	7.49
United Kingdom	:	:	:	:
Bosnia and Herzegovina	17,221.4	15,267.3	1,954.10	11.35
North Macedonia	8,833.5	:	:	:
Albania	8,337.7	7,365.4	972.30	11.66
Serbia	36,658.5	:	:	:
Turkey	:	:	:	:

**Note:** Author's calculation of margin rate.

**Source:** Eurostat



**Picture 1:** Gross margin trade of the European Union  
**Source:** Author's picture

**Table 6:** Descriptive statistics

Statistics		Turnover or gross premiums written - million euros	Total purchases of goods and services - million euros	Gross margin – one million euros	Gross margin, %
N	Valid	35	33	33	33
	Missing	4	6	6	6
Mean		541032.8629	493154.8727	79289.3152	12.9518
Median		118489.1000	111177.6000	16986.7000	13.0000
Std. Deviation		1500570.56000	1321126.34500	220544.79810	2.94447
Minimum		8337.70	7365.40	819.70	7.02
Maximum		8745002.60	7497188.10	1247814.50	22.05

**Note:** Author's calculation

In the trade of the European Union, the margin rate ranges from 7.02% ( Luxembourg) to 22.05% (Ireland). In the leading countries of the European Union, the trade margin rate is Germany at 15.15%, France at 16.48%, and Italy at 13.48%. In the countries of the Serbian region, the trade margin rate is Croatia 13.22% and Slovenia 13.15%. The trade margin rate in Bosnia and Herzegovina is 11.35%. In Albania, the trade margin rate is 11.66%. In Serbia, the trade margin rate is 15.79. Therefore, the trade margin rate in Serbia is higher than in Croatia and Slovenia. The trade margin rate in the European Union and Serbia is lower than in the US

**Determinants of the size of the trade margin in Serbia.** The trade margin in Serbia is calculated as the difference between the sale and the purchase value of the realized goods. The trade margin rate was calculated by dividing the margin by sales times 100. Table 7 and Picture 2 show the trade margin of Serbia for the period 2013 - 2022. Descriptive statistics of the analyzed statistical variables of trade in Serbia are shown in Table 8.

**Table 7:** Gross margin trade in Serbia

	(O) Sales	(I) Cost of goods sold	(O) Margin	(I) Operating costs	(I) Earnings of employees	(A) Net profit	(I) Inventory	% margin from inventory	% margin from sales	% operating costs from sales	% employees' earnings from sales	% net profit from sales
2013	2891518	2300147	591371	501641	151978	89730	481802	122.74	20.45	17.35	5.26	3.10
2014	2594602	2244057	350545	263590	154833	86955	472615	74.17	13.51	10.16	5.97	3.35
2015	2731999	2358585	373414	278149	164718	95265	537135	69.52	13.67	10.18	6.03	3.49
2016	3009651	2590399	419252	314014	180367	105238	584764	71.70	13.93	10.43	5.99	3.50
2017	3172393	2705077	467316	344589	194924	122727	614021	76.11	14.73	10.86	6.14	3.87
2018	3361094	2868190	492904	371088	218410	121816	577828	85.30	14.66	11.04	6.50	3.62
2019	3608329	3070400	537929	398520	238022	139409	669912	80.30	14.91	11.04	6.60	3.86
2020	3664505	3085928	578577	407567	262322	171010	726433	79.65	15.79	11.12	7.16	4.67
2021	4366762	3621202	745560	455549	301793	290011	818986	91.03	17.07	10.43	6.91	6.64
2022	5012305	4205473	806832	560616	341873	246216	982779	82.10	16.10	11.18	6.82	4.91

**Note:** Data in absolute amounts are expressed in millions of dinars. Margin and rates are the author's calculation. (I) – Input elements. (O) – Output elements

**Source:** Agency for Economic Registers of the Republic of Serbia



**Picture 2:** Margin of trade in Serbia

**Source:** Author's picture

**Table 8:** Descriptive statistics of initial data.

Statistics		(O) Sales	(I) Cost of goods sold	(O) Gross Margin	(I) Operating costs	(I) Earnings of employees	(A) Net profit	(I) Inventory	% margin from inventory	% margin from sales	% operating costs from sales	% employees' earnings from sales	% net profit from sales
N	Valid	10	10	10	10	10	10	10	10	10	10	10	10
	Missing	0	0	0	0	0	0	0	0	0	0	0	0
Mean		3441315.8000	2904945.8000	536370.0000	389532.3000	220924.0000	146837.7000	646627.5000	83.2620	15.4820	11.3790	6.3380	4.1010
Median		3266743.5000	2786633.5000	515416.5000	384804.0000	206667.0000	122271.5000	599392.5000	79.9750	14.8200	10.9500	6.3200	3.7400
Std. Deviation		759355.44860	624128.50570	150251.30190	95993.65451	64792.37596	69489.44198	159400.41130	15.28440	2.07709	2.13394	.56596	1.05768
Minimum		2594602.00	2244057.00	350545.00	263590.00	151978.00	86955.00	472615.00	69.52	13.51	10.16	5.26	3.10
Maximum		5012305.00	4205473.00	806832.00	560616.00	341873.00	290011.00	982779.00	122.74	20.45	17.35	7.16	6.64

**Note:** Author's calculation

In the trade of Serbia, the sales margin rate in the period 2013-2022 ranged from 13.51% (2014) to 20.45% (2013). The average sales margin rate in Serbian trade is 14.82%. In 2022, the sales margin rate is lower compared to 2021. The rate of margin from stocks in Serbian trade ranges from 69.52% (2015) to 122.74% (2013). In 2022, compared to 2021, the margin rate from inventory is lower. The average rate of margin from stocks in Serbian trade is 79.97%. The rate of operating expenses from sales in Serbian trade ranges from 10.16 (2014) to 17.35% (2013). In 2022, compared to 2021, the rate of operating expenses from sales is higher, partly due to higher energy costs. The average rate of operating expenses from sales in Serbian trade is 10.95%. The rate of earnings of employees from sales ranges from 5.26% (2013) to 7.16% (2020). The salary rate of employees from sales in 2022 is lower compared to 2021. The average salary rate of employees from sales in trade in Serbia is 6.32%. The rate of net profit from sales ranges from 3.10% (2013) to 6.64% (2021). The rate of net profit of trade in Serbia is lower in 2022 compared to 2021. The average rate of net profit of trade in Serbia is 3.74%. Therefore, the decrease in the net profit of trade in Serbia in 2022 compared to 2021 was influenced by the increase in operating costs, among other things, due to increased energy costs due to the energy crisis. Table 9 shows the correlation matrix of the observed statistical variables in connection with the trade margin in Serbia.

**Table 9:** Correlation

Correlations		(O) Sales	(I) Cost of goods sold	(O) Gross Margin	(I) Operating costs	(I) Earnings of employees	(A) Net profit	(I) Inventory	% margin from inventory	% margin from sales	% operating costs from sales	% employees' earnings from sales	% net profit from sales
(O) Sales	Pearson Correlation	1	.995 **	.919 **	.771 **	.983 **	.922 **	.978 **	.063	.252	-.146	.731 *	.787 **
	Sig. (2-tailed)		.000	.000	.009	.000	.000	.000	.863	.483	.687	.016	.007
	N	10	10	10	10	10	10	10	10	10	10	10	10
(I) Cost of goods sold	Pearson Correlation	.995 **	1	.877 **	.713 *	.988 **	.912 **	.985 **	-.029	.159	-.232	.766 **	.778 **
	Sig. (2-tailed)	.000		.001	.021	.000	.000	.000	.937	.660	.519	.010	.008
	N	10	10	10	10	10	10	10	10	10	10	10	10

(O) Gross margin	Pearson Correlation	.919 **	.877 **	1	.935 **	.864 **	.871 **	.854 **	.436	.611	.225	.512	.745 *
	Sig. (2-tailed)	.000	.001		.000	.001	.001	.002	.208	.061	.533	.130	.014
	N	10	10	10	10	10	10	10	10	10	10	10	10
(I) Operating costs	Pearson Correlation	.771 **	.713 *	.935 **	1	.680 *	.640 *	.680 *	.642 *	.771 **	.517	.265	.470
	Sig. (2-tailed)	.009	.021	.000		.031	.046	.031	.045	.009	.126	.460	.171
	N	10	10	10	10	10	10	10	10	10	10	10	10
(I) Earnings of employees	Pearson Correlation	.983 **	.988 **	.864 **	.680 *	1	.929 **	.977 **	-.046	.149	-.264	.842 **	.822 **
	Sig. (2-tailed)	.000	.000	.001	.031		.000	.000	.899	.681	.462	.002	.003
	N	10	10	10	10	10	10	10	10	10	10	10	10
(A) Net profit	Pearson Correlation	.922 **	.912 **	.871 **	.640 *	.929 **	1	.907 **	.056	.255	-.229	.741 *	.961 **
	Sig. (2-tailed)	.000	.000	.001	.046	.000		.000	.879	.477	.525	.014	.000
	N	10	10	10	10	10	10	10	10	10	10	10	10
(I) Inventory	Pearson Correlation	.978 **	.985 **	.854 **	.680 *	.977 **	.907 **	1	-.092	.132	-.262	.769 **	.784 **
	Sig. (2-tailed)	.000	.000	.002	.031	.000	.000		.800	.717	.465	.009	.007
	N	10	10	10	10	10	10	10	10	10	10	10	10
% margin from inventory	Pearson Correlation	.063	-.029	.436	.642 *	-.046	.056	-.092	1	.955 **	.927 **	-.373	.005
	Sig. (2-tailed)	.863	.937	.208	.045	.899	.879	.800		.000	.000	.288	.988
	N	10	10	10	10	10	10	10	10	10	10	10	10
% margin from sales	Pearson Correlation	.252	.159	.611	.771 **	.149	.255	.132	.955 **	1	.874 **	-.209	.200
	Sig. (2-tailed)	.483	.660	.061	.009	.681	.477	.717	.000		.001	.563	.579
	N	10	10	10	10	10	10	10	10	10	10	10	10
% operating costs from sales	Pearson Correlation	-.146	-.232	.225	.517	-.264	-.229	-.262	.927 **	.874 **	1	-.569	-.301
	Sig. (2-tailed)	.687	.519	.533	.126	.462	.525	.465	.000	.001		.086	.398
	N	10	10	10	10	10	10	10	10	10	10	10	10
% employees' earnings from sales	Pearson Correlation	.731 *	.766 **	.512	.265	.842 **	.741 *	.769 **	-.373	-.209	-.569	1	.736 *
	Sig. (2-tailed)	.016	.010	.130	.460	.002	.014	.009	.288	.563	.086		.015
	N	10	10	10	10	10	10	10	10	10	10	10	10
% net profit from sales	Pearson Correlation	.787 **	.778 **	.745 *	.470	.822 **	.961 **	.784 **	.005	.200	-.301	.736 *	1
	Sig. (2-tailed)	.007	.008	.014	.171	.003	.000	.007	.988	.579	.398	.015	
	N	10	10	10	10	10	10	10	10	10	10	10	10
**. Correlation is significant at the 0.01 level (2-tailed).													
*. Correlation is significant at the 0.05 level (2-tailed).													

**Note:** Author's calculation

So, in the specific case, there is a strong correlation between margin and sales, the purchase value of realized goods, operating expenses, salary of employees, net profit, and inventory, at the level of statistical significance. There is a strong correlation between the rate of margin on sales and the rate of margin on inventory and the rate of operating expenses of trade in Serbia. All this indicates that effective management of components can significantly influence the achievement of the target trade margin in Serbia.

**The influence of the margin factor on the efficiency of trade in Serbia .** In this study using DEA ( Data Envelopment Analysis) analysis of input orientation with constant return, we will examine the impact of margin factors (sales, purchase value of realized goods, operating costs, salary of employees, net profit, and stocks) on the efficiency of trade in Serbia. The input elements are the purchase value of the realized goods, operating costs, wages of employees, and stocks. Output elements are sales, margin, and net profit. The DEA model of input orientation with constant return reads: The CCR model is based on fixed or constant returns to scale. This means that a proportional increase in all inputs results in the same proportional increase in all outputs. The dual of CCR efficiency is expressed as:

*Min*  $\theta$

at the limit

$$\sum_{j=1}^n \lambda_j x_{ij} \leq \theta x_{i0} \quad i = 1 \dots m$$

$$\sum_{j=1}^n \lambda_j y_{kj} \geq y_{k0} \quad k = 1 \dots s$$

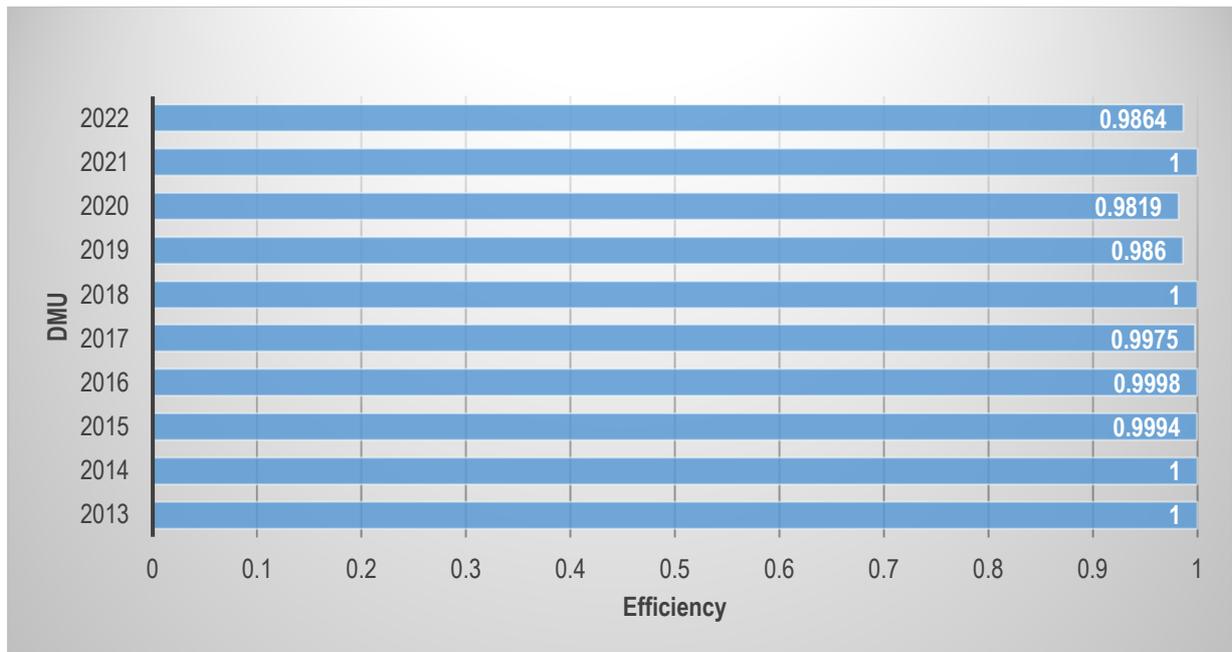
$$\lambda \geq 0 \quad j = 1 \dots n \quad (1)$$

where  $\theta$  is the technical efficiency of the unit DMU 0 ,  $\lambda$  is a dual variable for identifying comparable inefficient units. If  $\theta^*$  is equal to one, the observed DMU unit is technically efficient. Table 10 and Picture 3 show the results of the DEA model of input orientation with constant yield.

**Table 10:** Model = CCR-I

Model = CCR-I										
No.	DMU	Score	Rank		References (Lambda)					
1	2013	1	1	2013	1					
2	2014	1	1	2014	1					
3	2015	0.9994	6	2014	0.991	in 2021	0.037			
4	2016	0.9998	5	2013	0.037	in 2014	1.057	in 2021	0.036	
5	2017	0.9975	7	2013	0.093	in 2014	0.831	in 2021	0.171	
6	2018	1	1	2018	1					
7	2019	0.986	9	2013	0.084	in 2014	0.371	in 2018	0.112	in 2021
8	2020	0.9819	10	2013	0.09	in 2021	0.78			
9	2021	1	1	2021	1					
10	2022	0.9864	8	2013	0.153	in 2014	0.075	in 2021	1.002	
	Average	0.9951								
	Max	1								
	Min	0.9819								
	St Dev	0.0073								

**Note:** Author's calculation.



**Picture 3:** Model = CCR-I  
**Source:** Author's picture

A unit is considered effective if the score is equal to one. If not, then the unit is ineffective. In the specific case, 4 units are efficient and 6 units are ineffective. Therefore, Serbia's trade was efficient in 2013, 2014, 2018 and 2021. In other years it was ineffective (2015, 2016, 2017, 2019, 2020, and 2022). The projection of input/output elements shows in which units and input and output elements the given values should be corrected to achieve an efficiency score equal to unity. Table 11 shows the projection of the impact of the margin factor on the efficiency of trade in Serbia.



Thus, for example, to achieve the projected efficiency of trade in Serbia in 2022 in this particular case, it was necessary to reduce the purchase value by 1,355%, operating costs by 1,355%, employee wages by 1,355%, and inventories by 5,397% and increase the margin by 7.065% and net profit by 26.36%. Table 12 shows Slack. Slack shows what measures should be taken to convert inefficient units into efficient ones.

**Table 12: Slack**

Model = CCR-I										
No.	DMU	Score	Rank	Slack Cost of goods sold	Slack Operating costs	Slack Earnings of employees	Slack Inventory	Slack Sale	Slack Gross margin	Slack Net profit
1	2013	1	1	0	0	0	0	0	0	0
2	2014	1	1	0	0	0	0	0	0	0
3	2015	0.9994	6	0	0	79,847	38313	0	1391.12	1555.17
4	2016	0.9998	5	0	0	0	37249.1	0	518,753	581,637
5	2017	0.9975	7	0	0	0	34806.4	0	6661.12	7509.65
6	2018	1	1	0	0	0	0	0	0	0
7	2019	0.986	9	0	0	0	0	0	42946.8	48521.1
8	2020	0.9819	10	0	0	8601.98	31429.8	0	55828.9	63202.4
9	2021	1	1	0	0	0	0	0	0	0
10	2022	0.9864	8	0	0	0	39722.7	0	56999.8	64598.2
		Score	Rank	Cost of goods sold	Operating costs	Earnings of employees	Inventory	Sale	Gross margin	Net profit
	Average	0.9951	4.9	0	0	868.182	18152.1	0	16434.7	18596.8
	Max	1	10	0	0	8601.98	39722.7	0	56999.8	64598.2
	Min	0.9819	1	0	0	0	0	0	0	0
	St Dev	0.0073	3.6347	0	0	2717.49	19257.3	0	24845.9	28131.6

Note: Author's calculation

In the specific case, therefore, to, for example, achieve efficiency in 2022, it was necessary to reduce stocks by 39722.7, and increase the margin by 56999.8 and net profit by 63202.4 monetary units. All in all, if the target trade margin in Serbia is to be achieved, it is necessary to continuously analyze its size and structure. This is significant because the margin is one of the key performance indicators of trade in Serbia.

## 4.CONCLUSION

The investigation of the size and structure of the trade margin between the European Union and Serbia in this study showed the following: In European Union trade, the margin rate ranges from 7.02% ( Luxembourg) to 22.05% (Ireland). In the leading countries of the European Union, the trade margin rate is Germany at 15.15%, France at 16.48%, and Italy at 13.48%. In the countries in the region of Serbia, the trade margin rate is Croatia 13.22% and Slovenia 13.15%. The trade margin rate in Bosnia and Herzegovina is 11.35%. In Albania, the trade margin rate is 11.66%. In Serbia, the trade margin rate is 15.79. The trade margin rate in Serbia is higher than in Croatia and Slovenia. In the trade of Serbia, the sales margin rate in the period 2013-2022. ranged from 13.51% (2014) to 20.45% (2013). The average sales margin rate in Serbian trade is 14.82%. In 2022, it is smaller compared to 2021. The rate of margin from stocks in Serbian trade ranges from 69.52% (2015) to 122.74% (2013). In 2022, compared to 2021, the margin rate from inventory is lower. The average rate of margin from stocks in Serbian trade is 79.97%. The rate of operating expenses from sales in Serbian trade ranges from 10.16 (2014) to 17.35% (2013). In 2022, compared to 2021, the rate of operating expenses from sales is higher, partly due to higher energy costs. The average rate of operating expenses from sales in Serbian trade is 10.95%. The rate of earnings of employees from sales ranges from 5.26% (2013) to 7.16% (2020). The salary rate of employees from sales in 2022 is lower compared to 2021. The average salary rate of employees from sales in trade in Serbia is 6.32%. The rate of net profit from sales ranges from 3.10% (2013) to 6.64% (2021). The rate of net profit of trade in Serbia is lower in 2022 compared to 2021. The average rate of net profit of trade in Serbia is 3.74%. The decrease in the net profit of trade in Serbia in 2022 compared to 2021 was influenced by the increase in operating costs due to increased energy costs due to the energy crisis. In this specific case, there is a strong correlation between margin and sales, the purchase value of realized goods, operating expenses, employee earnings, net profit, and inventory,

and that at the level of statistical knowledge. There is a strong correlation between the rate of margin on sales the rate of margin on inventory and the rate of operating costs of trade in Serbia. This means, in other words, that the target trade margin in Serbia can be achieved by effective control of its components.

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**Kristina Peštović**

University of Novi Sad, Faculty of Economics  
 in Subotica  
 Subotica, Serbia  
 kristina.pestovic@ef.uns.ac.rs

**Teodora Ilić**

University of Novi Sad, Faculty of Economics  
 in Subotica  
 Subotica, Serbia  
 teodora.tica@ef.uns.ac.rs

**Dušan Saković**

University of Novi Sad, Faculty of Economics  
 in Subotica  
 Subotica, Serbia  
 dusan.sakovic@ef.uns.ac.rs

**Dijana Rađo**

PhD Student at University of Novi Sad,  
 Faculty of Economics in Subotica

dijana.radjo@efsa.unsa.ba

## THE QUALITY OF FINANCIAL STATEMENTS DURING THE CRISIS PERIOD

**Abstract:** The aim of this paper is to investigate the quality of financial statements during the period of crisis. The crisis has a negative effect on the business performance of a company. It is necessary to measure and analyze various aspects of performance and take timely corrective actions in order to achieve business stability. Quality of financial statements can be expressed as one of the business performances. High-quality financial statements are created in an accurate, timely and reliable manner in accordance with all requirements of regulation. Professional accounting regulation determines a large number of obligatory disclosures which have a direct impact on the quality of financial statements. This paper will analyze the quality of financial statements from the aspect of disclosures according to the International Accounting Standard 2 – Inventory (IAS 2). Inventory represents significant assets for production and trade companies. Therefore, the quality of disclosures according to IAS 2 can be significant for adequate business decisions. The research is based on a sample of agricultural and manufacturing companies registered in the AP Vojvodina during the period 2020-2021. The research is based on a descriptive analysis of the quality of disclosures according to the IAS 2 and financial reporting quality index. The results indicate that 41% of the obligatory disclosures are presented in companies reports. Accounting policy for inventories and carrying amount according to inventory classification are identified as disclosures of high quality. On the other hand, disclosure of the write-down of inventories, recognized as an expense for the period is identified at the lower quality level. The research can be of interest for managers, owners, and creators of financial statements in order to improve the quality of financial reporting as a result of disruption during the period of crisis.

**Keywords:** financial statements, quality, inventory

### 1. INTRODUCTION

Financial reporting is the collection, processing, analysis and presentation of accounting information based on company's operations for the decision-making purposes on behalf of a large number of users. Observing the users of accounting information, it is important to mention the division of users into internal (company management, professional services in the company, etc.) and external users (potential investors, creditors, the state, etc.). Regardless of who the users of accounting information are, the purpose of use is the same and is reflected in the decision making process, which has to ensure the efficient allocation of limited resources. The main goal of general-purpose financial statements is to provide data on the financial position, business assets, effects of business changes and other transactions of the reporting entity (IASB, 2018). In order to ensure this goal, it is necessary that financial statements provide data on assets, liabilities, capital, income, expenses, profit or loss, contributions and distributions to owners, as well as cash flows (IASB, 2009).

It is known that many corporations operating in different countries around the world, regardless of the degree of local development of regulatory accounting regulations, prepare financial statements for external users, and the way of reporting may differ. With the development of global business, there has been an integration of local and international markets, as well as the exchange of goods, services and information between countries. Under such conditions, entities perform a myriad of different transactions that require unique accounting treatments. For this reason, there was a need for standardization of accounting regulations, in which international professional bodies contributed the most, which enabled greater transparency and comparability of information, as well as better understanding and trust by interested parties.

The regulatory basis of financial reporting represents a methodological framework of financial reporting for business entities and consists of a set of laws, regulations, standards and principles that regulate the way financial reports are prepared and presented. The regulatory framework of financial reporting can be grouped into three segments, or levels: professional accounting regulations, legislative and internal accounting regulations. The first level is the most comprehensive and represents the international element in the formation of accounting methodology, which includes professional regulatory bodies and committees that are authorized to define accounting standards. The two most important boards that belong to this level are the International Accounting Standards Board, IASB and the Financial Accounting Standards Board, FASB. The International Accounting Standards Board (IASB) has created the International Financial Reporting Standards, which include Standards and Interpretations, namely:

- International Financial Reporting Standards, abbreviated as IFRS,
- International Accounting Standards, abbreviated IAS,
- International Financial Reporting Interpretations Committee abbreviated as IFRIC, and
- Conceptual Framework for Financial Reporting.

Professional regulations through individual accounting standards define a set of mandatory disclosures of information in the company's financial reports. Publishing information in a complete and accurate manner ensures financial reporting of a high level of quality. Nowadays, accountants are faced with a big challenge, which is precisely reflected in the fact of how to adequately respond to the requirements of standards regarding the publication of information in financial reports. The professional regulation defines which information is of a binding nature in terms of publication, which is of a voluntary nature and finally which additionally affects the component of improving the quality of financial reporting of the company. On the other hand, the professional regulation does not define the way in which specific information should be published, which represents an additional challenge for accountants in terms of providing reasonable, complete and accurate information according to the requirements of the standard.

The paper will analyze the quality of financial reporting of companies registered on the territory of AP Vojvodina for the period 2020-2021. The quality analysis should indicate the extent to which companies comply with the requirements of professional regulations in terms of reporting, especially from the aspect of publishing information on stocks according to IAS 2 - Inventories in a period of crisis. Furthermore, the results of the research will indicate critical areas and possible ways for improvement of quality of the company's financial reporting.

## **2. LITERATURE REVIEW**

Professional accounting regulations are the first pillar in ensuring a high-quality financial reporting system. The specific advantages realized by the implementation of professional regulations, especially IAS/IFRS, are reflected in the following (IFRS, 2023):

- Ensuring transparency due to the improvement of international comparability and improvement of the quality of financial reporting.
- Implementation of standards strengthens management accountability by reducing the information gap between capital owners and people entrusted with capital management.
- Improving economic efficiency by helping investors identify opportunities and risks globally along with the improvement of capital and resource allocation.
- At the level of an individual company, the standardization of financial reporting provides a unique and reliable accounting language and reduces the costs of international financial reporting.

When talking about the quality of financial reporting, it is necessary to highlight the components that determine the quality of the financial reporting system. According to the Conceptual Framework (IASB, 2018), for financial information to be useful, it must be relevant and of a fairly manner in terms of what it represents. The usefulness of information in financial reports is further increased if it is comparable, verifiable, timely and understandable.

The question of the quality of financial statements is a subject of study for a large number of authors and professional accounting organizations. The quality of financial reports is studied from different aspects, which can, for example, include an assessment of the quality of the financial report as a whole or, for instance, assessment of the quality of the financial report at the level of the requirements of a particular standard of professional regulation.

The quality of financial reporting on property, plant and equipment in Serbia indicates that companies do not sufficiently meet the requirements of IAS 16 –Property, Plant and Equipment (Obradović, 2014). The authors emphasize low level of quality of financial reporting on property, highlighting in particular that there are companies that have not published even basic information on property, such as basis of measurement and used method of property depreciation.

Through descriptive analysis, research was conducted on the quality of financial reports of companies in Serbia from the aspect of reporting on related parties (Jakšić, 2010). The results of the research show significant deviations from the requirements of the International Accounting Standards, primarily with regard to the disclosure of the remuneration of key management personnel, as well as the terms and conditions under which transactions between related parties were carried out. Full disclosure of information in accordance with current regulations was made in 19% of the investigated financial reports.

Research on the relationship between company size and the quality of financial reporting was conducted by Glaum et al. (2013). The authors point out that the size of the company is a key factor that affects the level and quality of publishing information according to the requirements of professional regulations. The results of their research showed that larger companies allocate more funds for the needs of financial reporting and improvement of the quality of financial reporting in comparison to smaller companies.

The quality of financial reporting according to the requirements of IAS 41 - Agriculture was analyzed at the level of companies in Serbia for the period 2014-2016. Among other results, the authors emphasize the low level of quality, stating that on average only 29% of mandatory information is published at the company level according to the requirements of IAS 41. Also, it is noticeable that there are companies that do not publish any information according to the requirements of IAS 41 (Mirović et al. 2019).

Research on the quality of reporting according to the requirements of IAS 16, at the level of hotel companies in Serbia and Croatia was conducted on the basis of financial reports from 2019. The research results indicate that the fair value model, as a method of subsequent recognition, is more common among hotel companies in Serbia, while in Croatia most hotel companies apply the historical cost method. In companies of both observed countries, the needed for improvement of the quality of financial reporting according to the requirements of IAS 16 is recognized, given that the companies do not fully meet the requirements of the specified standard (Milašinović et al., 2022).

Hladika et al. (2021) investigated the quality of reporting on the subsequent measurement of property, plant and equipment according to the requirements of professional regulation at the level of 500 large and medium-sized companies in Croatia. The research was conducted at the level of financial reports for the period 2014-2018. The author identified that there is 20% of companies that fulfill all disclosure requirements for revalued property, plant, and equipment, according to IAS 16 and fair value according to IFRS 13. Further, low level of financial reporting quality can be explained by the fact that there are 48% of companies that do not fulfill the requirements of the standards (IAS 16 and IFRS 13) and do not disclose any information on revaluation and fair value.

### 3. METHODOLOGY

The main goal of this paper is to investigate the quality of financial reporting of companies registered in the territory of the AP Vojvodina, particularly from the aspect of fulfilling the requirements regarding the publication of information on inventories according to IAS 2 - Inventories. Inventories represent the company's current assets, whose lifespan is less than 12 months. The basic forms of inventories are inventories of material, unfinished production, finished products, goods, etc. Inventories are of a high importance for the regular implementation of business activities, because they ensure a smooth running of the business processes. On the other hand, quantities of inventory larger than necessary can create expenses for the company due to their depreciation over time (Bragg, 2010). In most agricultural and manufacturing companies, inventories represent a significant category in total assets. Adequate inventory reporting can therefore have a decisive impact on the quality of a company's financial reporting (Hulya, 2020).

The quality of inventory disclosure according to the requirements of professional regulation is viewed from two aspects. The first aspect includes a descriptive analysis of financial reporting on inventory of each individual request at the level of enterprises in the Autonomous Province of Vojvodina. IAS 2 defines a range of mandatory and voluntary reporting on inventories in paragraph 36 (IASB, 2005). The reporting of inventories according to the requirements of IAS 2 was observed based on the existence of:

- accounting policy for inventories,
- carrying amount, generally classified as merchandise, supplies, materials, work in progress, and finished goods,
- the book value of inventory is carried at fair value reduced by the costs of sales,
- cost of inventories is recognized as an expense (cost of goods sold),
- amount of any write-down of inventories is recognized as an expense for the period,
- other information such as carrying amount of inventories pledged as security for liabilities, amount of any reversal of a write-down to NRV and the circumstances that led to such a write-down.

The second aspect of the analysis includes the evaluation of the quality of disclosure at the level of IAS 2 - Inventories according to the quality index of financial reporting. When calculating the quality index of financial reporting, other information regarding individual standards will not be taken into account, since this information cannot be verified from the aspect of existence or non-existence only based on an insight into the financial statements. The quality index of financial reporting is calculated according to the following formula (Goncalves et al., 2014).

$$IndexFI = \sum \frac{d_i}{m}$$

Symbol translation:

IndexFI – financial reporting quality index,

$d_i = 0$  or  $1$ ,

$d_i = 1$  if the requirements are disclosed,

$d_i = 0$  if the requirements are not disclosed,

$m =$  maximum number of requests that can be disclosed.

The research in this paper was conducted on the basis of a sample of 216 observations of companies registered in AP Vojvodina for the period from 2020-2021. For the purpose of this research, the sample was formed on the basis of financial reports of companies from the sector registered on the territory of AP Vojvodina, which are publicly available on the website of the Agency for Business Registers (The Serbian Business Registers Agency, 2023).

## 4. RESULTS AND DISCUSSION

Following are the results of the conducted research on the quality of inventory reporting according to IAS 2. IAS 2, paragraph 25, requires that inventory output values are calculated according to FIFO (first-in-first-out) or according to the weighted average cost method, whereby the same method should be used to calculate the output of stocks of similar nature and similar purpose. Adopted policies and accounting methods should be presented in the financial statements. From the total number of observed companies for the period of 2020-2021, 87.04% reports on accounting policies and the method for calculating the inventory output. On the other hand, 12.96% of companies that have the stated the value of inventory in their financial statements do not display the specified mandatory information (table 1).

**Table 1.** Disclosure of accounting policy for inventories

Accounting policy for inventories	2020-2021
Average cost	85.19%
FIFO	1.85%
No information	12.96%
<b>Total</b>	<b>100.00%</b>

Source: Authors' calculation

Table 2 presents the results of the research on the quality of reporting using the book value for inventories according to the classification of inventories included in the notes to the financial statements. It is noticeable that 70.37% of companies publish more detailed information about the types of inventories in the notes to the financial statements.

**Table 21.** Disclosure of carrying amount, generally classified as merchandise, supplies, materials, work in progress, and finished goods.

Carrying amount for inventories	2020-2021
Yes	70.37%
No	29.63%
<b>Total</b>	<b>100.00%</b>

Source: Authors' calculation

IAS 2 establishes the possibility of recording inventory at fair value reduced by sales costs, and thus creates the obligation to report on these inventories. At the level of companies in AP Vojvodina, 9.26% of companies report on the fair value of inventory reduced by sales costs. Looking further at the requirements of IAS 2, the standard dictates that the book value of sold inventories is recognized as an expense of the period in which the income associated with them is recognized. In regards to that, the amount of expended supplies has to be disclosed in the financial statements. Observing the fulfillment of the aforementioned request for the period 2020-2021, 45.37% of companies reported on the previously mentioned information in their financial statements (table 3).

**Table 3.2** Disclosure of cost of inventories recognized as expense

Disclosure of cost of inventories recognized as expense	2020-2021
Yes	46.30%
No	53.70%
<b>Total</b>	<b>100.00%</b>

Source: Authors' calculation

Regarding the fulfillment of the requirements for reporting on inventory write-offs, it is noticeable that 40.74% of companies present the previously mentioned information in their financial reports (Table 4). This result should be carefully analyzed, because the write-off reporting is related to the existence of the inventory write-off, and not only to the mere existence of the inventory as an asset of the company.

**Table 4.3** Disclosure of amount of any write-down of inventories recognized as an expense in the period

Write-down of inventories	2020-2021
Yes	40.74%
No	59.26%
<b>Total</b>	<b>100.00%</b>

Source: Authors' calculation

The following table presents the quality of reporting on other information related to inventory. The only additional information is about inventory pledged as a guarantee, which was shown by 10.19% of companies in AP Vojvodina. It should be noted that no companies have been identified that disclosed information regarding the cancellation of write-offs. Also, companies that disclosed information regarding events that did not happen were not identified, which may be of interest to business decision makers.

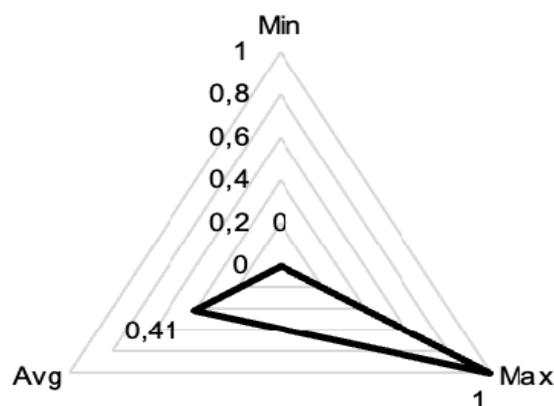
**Table 5.** Disclosure of other information according to IAS 2

Other information about inventory	2020-2021
Reversal of write-off	0%
Carrying amount of inventories pledged as security for liabilities	11.11%
Transaction that was not realized in previous period	0%

Source: Authors' calculation

Observing the quality index of financial reporting according to IAS 2, it can be seen that the average value of the index is 0.41, which means that on average companies publish 41% of the observed information (Picture 1). It should be noted that there are companies that fully publish all the required information according to the requirements of IAS 2. The quality of financial reporting on inventories at these companies is assessed at an extremely high level. On the other hand, there is a smaller number of companies that do not publish any required information in accordance with the requirements of IAS 2.

### Financial reporting quality index (IAS 2)



**Picture 1:** Financial reporting quality index according to IAS 2

Source: Authors' illustration

## 5. CONCLUSIONS

The quality of financial reporting on stocks of companies in AP Vojvodina according to IAS 2 is at a relatively acceptable level, given that almost all companies show accounting policies and methods of calculating inventory output, as well as information on the book value of inventory according to their classification. Reporting on the amount of inventory recognized as an expense during the period stands out as a critical area of financial reporting on inventories at companies in AP Vojvodina. Given that inventories have a shelf life of up to 12 months, companies must report on transactions that cause the expenditure of inventory during the accounting period. The results indicate that almost every other company in AP Vojvodina presents information on the expenditure recognized during the period regarding the inventory position.

Regarding the reporting of fair value, existence of write-offs, inventory provided as guarantees, research results must be taken with a grain of salt, considering that these reports are only related to the existence of the mentioned business events. Also, it is notable that companies do not provide additional information about transactions and events of those that did not occur, which could provide more complete information for business decision-making purposes. So, for example, even if there are no inventories that have been provided as a guarantee, the company can report this in its financial statements. In this way, complete and relevant information for business decision-making is provided and doubts among the users of financial statements are removed as to whether there are inventors provided as a guarantee without the company reporting this in their reports.

The results of this research indicate a stable level of quality reporting on inventories during the crisis period; 2020-2021. The existence of a relatively short research period can be highlighted as a limitation of the mentioned research. Future research should continue on the period of the crisis that was observed and conduct a trend analysis regarding the quality of financial reporting for the period during and after the crisis. The research results are primarily of interest to company management and accountants, who based on the identified critical areas can make decisions for the improvement of the quality of financial reporting. Also, the research results are of interest to external users in order to provide complete and relevant data for business decision-making.

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**Savović Slađana**Faculty of Economics, University of  
Kragujevac  
Kragujevac, Republic of Serbia  
ssladjana@kg.ac.rs**Domanović Violeta**Faculty of Economics, University of  
Kragujevac  
Kragujevac, Republic of Serbia  
vterzic@kg.ac.rs**Jovković Biljana**Faculty of Economics, University of  
Kragujevac  
Kragujevac, Republic of Serbia  
bjovkovic@kg.ac.rs

## **EFFECTS OF ACQUISITIONS ON FINANCIAL AND ESG PERFORMANCE: ANALYSIS OF SIEMENS MOBILITY'S FINANCIAL AND SUSTAINABILITY REPORTS**

**Abstract:** A large number of studies have investigated the effects of acquisitions on the financial performance of the companies involved. Financial reporting plays a crucial role in understanding the effects of acquisitions on financial performance. An important aspect of financial reporting in acquisition processes is audit procedures that are carried out to confirm the reliability and truthfulness of financial reports. While research on the effects of acquisitions on financial performance is dominant in the academic literature, very little research has analysed the impact of acquisitions on companies' sustainability and ESG performance. Sustainable business practices are becoming increasingly important in today's corporate world. Companies realize that ESG (environment, social and governance) factors can have a significant impact on their long-term success and profitability. ESG factors are important in acquisition processes as companies face increasing scrutiny and pressure for transparency regarding environmental risk, social justice and corporate governance. The aim of the research in the paper is to look at the effects of acquisitions on the financial and ESG performance of companies. The research was conducted on the example of Siemens Mobility, which was created by the acquisition of the Serbian company Milanović Inženjering by the German company Siemens. Financial statements of the company in the years before and after the acquisition, reports on the sustainability of the company, as well as other relevant documents were analysed. The special contribution of the work is reflected in the comprehensive overview of the effects of acquisitions on ESG performance of companies.

**Keywords:** Key words. Acquisitions, financial performance, ESG performance, sustainability.

### **1. INTRODUCTION**

Acquisitions represent global growth strategies by which the company stands to access new markets, take over key resources, and improve the performance of acquired companies. Analyzing at the effects of acquisition on performance is an important and current research area. The literature review shows that the largest number of studies investigates the effects of acquisition on financial performance (Callahan, 2004; Martynova et al., 2006; Guest et al., 2010, Cioli et al., 2020). In recent times, ESG issues have become increasingly important in acquisition transactions as companies face increasing scrutiny and pressure for transparency regarding climate risk, social justice and governance. Research on the effects of acquisitions on sustainability and ESG performance is very limited. Only a few papers have focused on the impact of an acquisition on ESG performance (Tampakoudis and Anagnostopoulou, 2020, Barros et al., 2022). In order to overcome this research gap, the aim of the paper is to look at the effects of the acquisition on the company's financial and ESG performance. According to the set research objective, the work includes the following research questions: 1) what is the effect of the acquisition on the financial performance of the company? and 2) what is the effect of the acquisition on the company's ESG performance? The research was conducted on the example of Siemens Mobility, which was created by the takeover of the Serbian company Milanović Inženjering by the German company Siemens. The financial reports of the company in the years before and after the acquisition, reports on the sustainability of the company, as well as other relevant documents and reports were analyzed.

The paper is structured as follows. First, a review of the literature on the effects of acquisitions on financial and ESG performance is provided. Second, the research methodology is described. Third, the results of the research and the discussion of the results are presented. At the end, concluding considerations are given; limitations and directions for future research are highlighted, as well as theoretical and practical implications of the work.

## 2. LITERATURE REVIEW

### 1.1. Acquisitions and financial performance

Acquisition performance measures can be divided into two broad groups: measures that have a financial domain (market performance measures and accounting performance measures) and measures that have a non-financial domain (innovation, customer satisfaction, ESG performance). Accounting performance measures are based on information contained in official financial reports and the calculation of various financial indicators in the period before and after the acquisition transaction. An essential prerequisite for analyzing financial indicators and making relevant conclusions about the success of the acquisition is the auditor's evaluation of the truthfulness of financial reports. The audit of financial statements is the procedure of checking and evaluating financial statements, as well as the data and methods used in the preparation of financial statements, on the basis of which an independent professional opinion is given on whether the financial statements in all materially significant aspects give a true and objective view of the financial situation and of the results of the operation of a legal entity in accordance with the relevant regulations for the preparation of financial statements (Act on Audit, Official Gazette 73/2019, 44/2021). Truthfulness implies that the financial statements have been prepared in accordance with International Accounting Standards and the Accounting Act (Official Gazette 73/2019 and 44/2021) and that they do not contain any material misstatements that may mislead users. Thanks to the performed audit process, the financial reports compiled by the management gain the necessary credibility and are suitable for making various business decisions by many users, such as planning the implementation of potential acquisitions, evaluating the success of the implemented acquisition, and the like.

In assessing the effects of acquisitions on financial performance, the following are most often used: net profit, operating profit, rate of return on assets (ROA - return on assets), rate of return on equity (ROE - return on equity), net profit rate (ROS - return on sale) (Callahan, 2004; Martynova et al., 2006; Guest et al., 2010, Cioli et al., 2020). Using accounting indicators to measure the success of acquisitions, Callahan (2004) comes to the conclusion that acquisitions contribute to increasing the rate of profitability. The results of the study showed that large company customers achieve a significant increase in the profit margin - ROS. Cioli et al. (2020) examine the effect of international acquisitions on the profitability of acquired companies and buyer companies, monitoring the following financial indicators: EBIT, EBITDA, ROA and ROIC (return on invested capital). The research results showed that profitability did not improve in the period three years after the acquisition. However, the authors emphasize the expectation that synergistic effects will be realized, but a longer period of three years is needed for their realization. In evaluating the effects of acquisitions, Viveiros (2018) uses accounting indicators: ROA, asset turnover, as the ratio of sales and assets (sales/assets) and EBIT Margin (gross profit margin, as the ratio of operating profit and income from sales - EBIT/sales). The assessment of the success of acquisitions was performed by comparing the value of the indicators three years after the takeover with the value of the indicators achieved in the year before the takeover (-1,+3). The results of the study showed that in the three-year period after the acquisitions, there was a decrease in the average value of the indicators.

### 1.1. Acquisitions and ESG performance

In measuring the acquisitions' performance, the use of indicators that have a financial domain prevails. Taking financial performance into account is based on the understanding that a certain acquisition is successful if it maximizes the return of the company in the form of an increase in the shares' value or an increase in profits. Non-financial performance measures, on the other hand, emphasize the importance of non-financial measures, such as innovation, customer satisfaction, ESG performance, which are significant for improving financial performance in the long term (Savović, 2018).

Recently, ESG performance has become increasingly important in M&A transactions. Companies that prioritize ESG performance will attract more investors and buyers. By proactively incorporating ESG practices into their operations and strategies, companies of all sizes and sectors can position themselves for long-term success. This not only benefits the companies themselves, but also contributes to a more sustainable and responsible global business environment (Costa, 2023). ESG considerations relate to environment - E (climate change and greenhouse gas emissions; energy efficiency; resource depletion, including water; hazardous waste; air, land and water pollution and waste management), social - S (human rights; working conditions; conflict; health and safety; employee relations; and equality and diversity) and governance - G (bribery and corruption; transparency; director payments, shareholder rights; independence, diversity and structure of the board of directors) (Burgess, et al., 2023). The ecological, social, management and economic spheres are interconnected so as to create one circular value chain of the offer. With such an integrated strategy, companies achieve a competitive advantage in the global market (Zhao et al., 2019). Hence, companies that

pay attention to the issue of sustainability can survive longer than companies that are only concerned with financial performance measures and can achieve greater market power (Cantele et al, 2020). Barros et al. (2022) analyze the impact of acquisitions on a company's sustainability performance by deconstructing ESG into its three components. The results of the study show that acquisitions increase a company's ESG. Analyzing the timing of this improvement, the authors conclude that this effect is not immediately visible - it was not verified in the year of the transaction, but in the following year.

## 2. RESEARCH METHODOLOGY

The research was conducted on the example of the company Milanović Inženjering that was taken over by the company Siemens in 2018. Table 1 shows basic information about the acquired company Milanović Inženjering.

**Table 1:** Basic information about the acquired company

Acquired company	Milanović Inženjering
Acquirer company	Siemens Mobility Holding B.V.
Year of the acquisition	2018
Type of the acquisition	International acquisition
The country of the origin of the acquirer company	Germany
Percentage of the assumed ownership	100%
Business activity	Metal machine
Sector	Manufacturing industry
Size of acquired company	Large legal entity
Legal form	Limited liability company
Full business name after acquisition	Siemens Mobility DOO Cerovac

Source: Agency for Business Registers

The performance of the acquired company was measured through accounting performance measures and the following indicators: net profit, EBITDA, EBITDA margin, net profit rate (ROS) and rate of return on assets (ROA). EBITDA is determined as operating profit increased by the amount of depreciation. EBITDA is profit before tax, interest and depreciation obtained as the difference between income and expenses, excluding tax, interest and depreciation. The EBITDA margin is determined as the ratio of the EBITDA indicator and the total operating revenue. The ROS rate was measured as the ratio of net profit to operating revenue, the ROA rate was measured as the ratio of net profit to the value of total assets. In order to identify the effects of the acquisition on financial performance, the change in the average value of profitability indicators was measured in two years before the acquisition, in relation to the period of four years after the acquisition. The data needed to calculate the financial indicators were taken from the official financial reports (balance sheet and income statement) of the analyzed company, available on the website of the Agency for Economic Registers of the Republic of Serbia). Based on data and information from the Company's Sustainable Development Report, as well as Annual Business Reports, relevant data and information were selected, based on which conclusions were drawn about ESG performance in the period after the acquisition.

## 3. RESULTS AND DISCUSSION

### 3.1. Financial performance

The financial statements, which the analyzed company compiles on September 30, were the subject of audit in all years of the mentioned period. In the years before the acquisition, the company Milanović Inženjering hired the audit firm Full revizija doo Surčin, which expressed a positive opinion on the disclosed financial statements in both audit reports. In the year of acquisition and the following two years, for the purpose of auditing financial statements, Siemens Mobility contracted services with the audit company Global Audit Services doo Belgrade, which expressed positive opinions on all evaluated financial statements. In the last two analyzed years, there has been a change in the engaged audit firm, and Siemens Mobility, as a company that operates on the global market, hired one of the 4 largest global audit firms, Ernst & Young Belgrade, for the audit of financial statements. Since it is a renowned auditing company of world renown, the positive opinions expressed on the financial reports of the last two years certainly instil a sufficient dose of confidence that the used financial data they contain can be a reliable basis for calculating the necessary indicators. Therefore, the financial reports present the objective and true financial situation and business outcomes in accordance with all accounting regulations and do not contain materially significant statements resulting from fraud or errors.

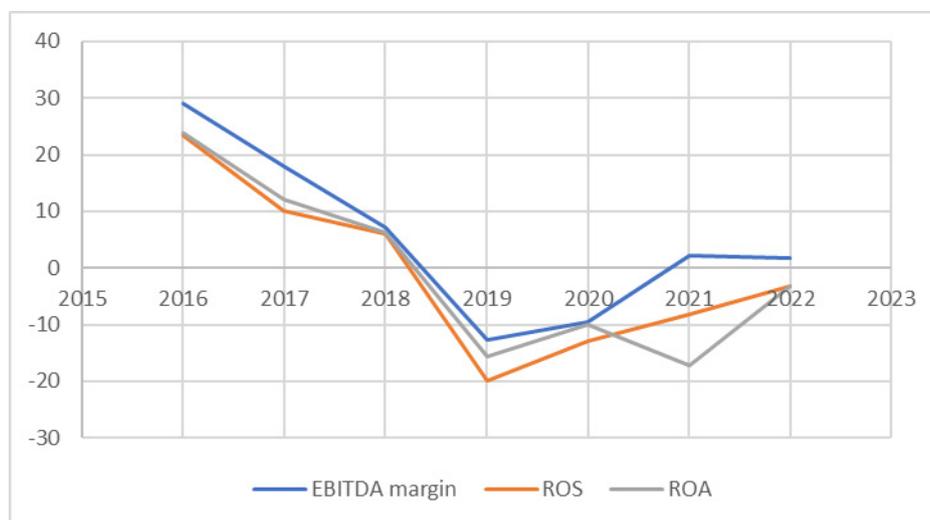
Table 2 presents the financial performance of Siemens Mobility (Milanović Inženjering) in the pre-acquisition and post-acquisition period (2016-2022). In the period before the acquisition, the company achieved a net profit and a positive EBITDA value, but these financial indicators have a decreasing trend. In the period after the acquisition, the company realizes a net loss. The causes of the net loss in the period after the acquisition are significant investments that the company undertook in this period (opening of the "Engineering" profit centre that required investments in employees, investment in staff training to work on the Avenio Bremen project). Investments in employee training, as well as a significant increase in the number of employees in the period after the acquisition caused a significant increase in employee costs. There was also an increase in intangible costs, due to the introduction of the new SAP information system, which required numerous IT and other consulting services. There was an increase in the costs of production services, since the services of external subcontractors were used due to the lack of own capacities. The causes of the loss are the increased fixed costs of renting office space and equipment for Assembly projects (tram assembly), for which the full degree of production capacity utilization is expected in the coming years (Annual Business Report Siemens Mobility d.o.o. Cerovac, 2021).

It can be seen that in the period before the acquisition, all profitability rates are significantly higher compared to the period after the acquisition. The trend of decreasing profitability indicators stops in the year after the acquisition, when these indicators start to improve, but are still at a lower level compared to the period before the acquisition. The expectation is that the trend of improvement will continue since the loss that has been realized is of a temporary nature, bearing in mind the fact that investment in the development and training of personnel represent the basis for business improvement in the future period of time, that is, they represent the driver of good future business performance of the company.

**Table 2:** Financial performance of the company Siemens Mobility (Milanović Inženjering) during the period 2016-2022 (in 000 RSD)

	2016	2017	Year of acquisition	2019	2020	2021	2022
Net profit	454.777	280.263	190.179	-521.953	-648.935	-1.112.691	-427.669
EBITDA	563.776	495.737	224.442	-334.465	-479.527	311.095	228.129
EBITDA margin	29.0%	17.9%	7.2%	-12.8%	-9.6%	2.3%	1.7%
ROS	23.4%	10.1%	6.1%	-20.0%	-12.9%	-8.2%	-3.2%
ROA	23.9%	12.2%	6.2%	-15,6%	-10.0%	-17.2%	-3.2%

**Source:** Authors' calculation based on data taken from official financial reports available on the website of the Agency for Economic Registers



**Figure 1.** Profitability indicators of the company Siemens Mobility (Milanović Inženjering) during the period 2016-2022

**Source:** Authors' calculation based on data taken from official financial reports available on the website of the Agency for Economic Registers

**Table 3:** Comparative analysis of the financial indicators of the company Siemens Mobility (Milanović Inženjering) before and after international acquisition

	<b>EBITDA margin</b>	<b>ROS</b>	<b>ROA</b>
Average indicator value before acquisition	23,5%	16,8%	18.5 %
Average indicator value after acquisition	-4.6%	-11.1%	11.5%
Change	Decrease	Decrease	Decrease

Source: Authors' calculation based on data taken from official financial reports available on the website of the Agency for Economic Registers

If the average value of indicators is compared in the period before and after the acquisition (Table 3), it can be concluded that the average EBITDA margin decreased in the period after the acquisition, as well as the average rate of ROS, while there was a decrease in the average rate of ROA. The average rate of ROE remained at the same level in the period after the acquisition and is 45%.

## 3.2. ESG performance

Siemens management is responsible for preparing the Sustainability Report. The Sustainability Report is compiled in accordance with the Global Reporting Initiative (GRI) standards. These responsibilities of company management include selecting and applying appropriate sustainability reporting methods and making assumptions and judgments about individual sustainability disclosures that are reasonable in the circumstances. Moreover, management is responsible for such internal control as management deems necessary to enable the preparation of reports that should represent the state of affairs truthfully, without fraud (manipulation of the report) or error. The report on sustainable development was the subject of an audit by Ernst & Young GmbH, whose auditors pointed out that "Based on the assurance procedures performed and the evidence obtained, nothing has come to our attention that causes us to believe that the Sustainability Report of Siemens Aktiengesellschaft for the period from October 1, 2022 to September 30, 2023 is not prepared, in all material respects, in accordance with the GRI criteria".

### 3.2.1. Environmental (E) indicator

Siemens Mobility, a division of Siemens, is engaged in engineering, tram assembly, construction and production of aluminium components and auxiliary tools for the rail vehicle industry. Siemens Mobility reduces CO2 emissions through electrification, automation of railway infrastructure and improvement of energy efficiency. For rail operators, energy consumption is the largest contributor to operating costs and a significant contributor to emissions. The company can reduce energy consumption and use of materials through energy efficient design (Mobility solutions for a better tomorrow, 2023). The company pays special attention to the control of significant aspects of the environment recognized in production, where through the implementation of global company programs it achieves significant results in reducing generated waste (hazardous, non-hazardous), and by applying innovative recycling technologies, implementing prescribed treatment of all types of generated waste, replacing hazardous substances less dangerous and harmless in accordance with the requirements of the technological process and the requirements for product quality. During the business year 2022, a total of 1,061.03 t of industrial and packaging waste and -35.90 t of hazardous waste were generated and delivered to authorize operators for prescribed disposal and/or further treatment (Annual Business Report, 2022).

In accordance with the requirements of the national and local register and based on the Siemens Environmental Protection Report, EHS Standard "EHS Reporting", the company submitted all the necessary statistical reports in the field of environmental protection. Within the fiscal year 2022, in order to improve and protect the environment and energy efficiency, Siemens Mobility had the following investments: noise measurement in the environment, waste analysis, professional trainings, a canopy for the storage of al veneer, waste disposal means; in order to invest in the circular economy, a contract was concluded with the company Salesinar - Operator for the rental of wiping cloths within the production processes; replacement of ventilation filters; installation of led reflectors. The largest investment value is in the replacement of ventilation filters: 34,000.00 euro (Annual Business Report Siemens Mobility d.o.o. Cerovac, 2023).

### 3.2.2. Social (S) indicator

Siemens Mobility pays special attention to the professional and personal development of its employees. The company fosters a culture of internal communication. We are actively working on empowering all employees in the company and their commitment to developing their own careers. In the field of employee development, apart from formal, internal and external trainings, and in accordance with new trends, employees have at their disposal a large number of free online trainings that provide them with the opportunity to be informed about topics that are not strictly in the description of their job. Also, employees have the possibility of further training through various programs and trainings where they

exchange experiences and thereby contribute to the improvement of the entire organization. For the prevention of injuries at work, quick professional response in case of injuries at work, some other bad health conditions, as well as the education of employees in terms of prevention of various types of diseases, in cooperation with the Health Centre Kragujevac, the Clinic of the Health Centre was opened at the location of the factory in Sobovica.

### **3.2.3. Governance (G) indicator**

At Siemens, sustainability is embedded in everything the company does, including their business purpose and strategy, corporate culture, processes and guidelines. The company strives to make sustainability everyone's responsibility. Compliance with known principles of corporate governance is the cornerstone of corporate governance based on sustainability. Siemens AG is governed by German corporate law, according to which a bicameral board structure has been established, consisting of an Executive Board (Managing Board) and a Supervisory Board (Supervisory Board). As the highest governing body, the Executive Board is responsible for serving the best interests of the company and for achieving sustainable growth of the company's value. Members of the Executive Board are responsible for the overall management of the company and decide on key issues of business policy and corporate strategy. The Supervisory Board supervises and advises the Executive Board in the management of the company's operations. The Supervisory Board meets regularly and discusses business development, planning, strategy and strategy implementation. In 2023, Siemens significantly facilitated the organization of sustainability throughout the company by introducing the Sustainability Executive Committee (EC SUS) and Heads of Sustainability in key businesses and business units. The Managing Board deals with sustainability-related risks and opportunities of strategic and company-wide importance and adopts appropriate measures. Chief Executive Officers (CEOs) are responsible for all sustainability topics in their area of responsibility. This includes responsibility for sustainable business, sustainability reporting, the Sustainability Risk Due Diligence Process, and other related responsibilities. The CEO of Siemens Mobility is supported by his Head of Sustainability Executive Committee to achieve his sustainability mandate. The current compensation system for the members of the Executive Board (Managing Board of Siemens AG) is effective from fiscal year 2020. It incorporates long-term performance incentives based on ESG criteria. The performance of the Executive Board (Managing Board's performance) is evaluated in relation to the internal ESG/Sustainability index. Goals include CO<sub>2</sub> emissions, hours of digital learning and the Net Promoter Score (NPS) for measuring customer satisfaction. Additional sustainability matters are also defined as individual targets for short-term variable compensation (bonuses).

## **4. CONCLUSION**

The issue of the companies' sustainability is becoming inevitable in modern academic and professional circles. This is especially considering the characteristics of the modern business environment, as extremely complex, heterogeneous, dynamic, uncertain and unpredictable. For the purpose of not only growth and development, but also long-term survival, companies must take into account, not only economic, but also other non-economic, that is environmental, social and corporate management performance. In that sense, the so-called ESG performance is becoming more and more prominent in the evaluation of the company's success, both of the acquirer and acquired company. ESG performance is gaining more and more importance in the pre-integration phase, during and after the integration of companies and undoubtedly affects the market value of all actors in the integration process. An important aspect of financial and non-financial reporting in acquisition processes is the audit procedures that are carried out to confirm the reliability and truthfulness of financial and sustainability reports.

ESG factors are important in acquisition processes as companies face increasing scrutiny and pressure for transparency regarding environmental risk, social justice and corporate governance. The research results show that, immediately after the integration of the observed company, the financial performance is not at an enviable level due to high fixed costs and costs of production services, but positive effects of integration on financial performance are expected in the longer term. The company, which is the subject of the analysis, pays significant attention to all aspects of sustainability and invests a lot of resources in the preservation and protection of the environment, solving social issues dedicated to the professional and personal development of employees, as well as employee education in terms of prevention of various types of diseases. The principles of corporate governance are also based on the principles of sustainability. However, the given research results refer to one company, which is a limitation of this research. In the future, the subject of research can be a larger sample of companies from one or more sectors of the economy.

The research results undoubtedly have a special theoretical and practical contribution. In a theoretical sense, the special contribution of the work is reflected in a comprehensive overview of the effects of acquisitions, not only on the financial, but also on the ESG performance of companies. This is of particular importance, bearing in mind the fact that the literature mainly measures the effects of acquisitions on financial performance. In a practical sense, the research results provide useful guidelines to all actors in the integration process for making valid conclusions and decisions both

in the phase before, during and after integration, which will ultimately lead to maximizing the market value of the integrated company.

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**Nikola Rakić**  
University in Novi Sad, Faculty of  
Economics in Subotica  
Subotica, Serbia

e-mail: nikola.rakic@ef.uns.ac.rs

## **TAX BENEFITS OF R&D IN CRISIS CIRCUMSTANCES - ACCOUNTING ASPECTS**

**Abstract:** In times of crisis, one of the major challenges for businesses is maintaining an appropriate level of liquidity. During periods marked by supply and/or demand shocks caused by various economic, political, or natural influences, most companies experience a drop in sales and a decreased likelihood of collecting receivables on time, if at all. In conditions of reduced business activity and lower cash inflows from operations, businesses are forced to seek additional sources of liquidity to ensure their survival despite the crisis. Tax reliefs can serve as a means for companies to secure additional liquidity sources, i.e., a way to reduce the costs they face. This paper primarily explores the possibility of reducing cash outflows related to gross wages paid. One form of tax relief available to companies in the Republic of Serbia is for research and development (R&D) activities. If a company decides to engage in R&D activities, it will pay a lower amount of taxes and contributions for employees involved in these activities, thereby saving funds and improving its liquidity. The paper presents which activities are considered R&D according to the legal and sub-legal regulations of the Republic of Serbia and the conditions necessary for a company to benefit from tax reliefs. Additionally, the paper discusses the accounting aspect of calculating wages for employees engaged in R&D activities.

**Keywords:** Research and Development (R&D), innovations, tax reliefs, liquidity.

### **1. INTRODUCTION**

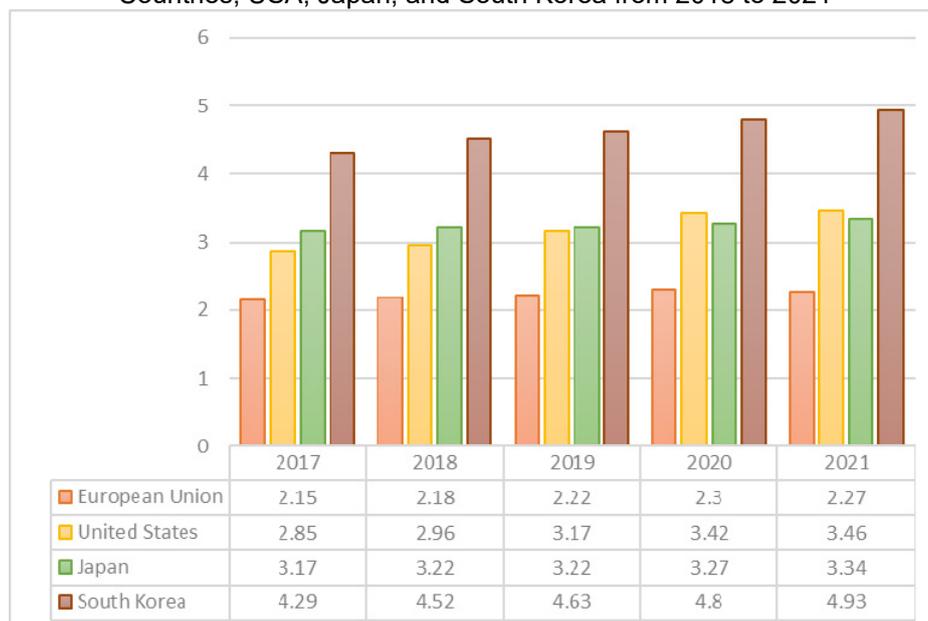
In the 21st century, R&D activities are considered key factors that can ensure growth and development at the level of companies, regions, countries, and the entire world. By creating new knowledge and successfully applying it through innovation, productivity, competitiveness, a higher number of jobs, and greater economic growth are achieved (Dajić, 2017). The intense pressure of globalization, reflected in a strong competitive battle, creates a constant need for innovation. Acquiring knowledge and skills in modern conditions of intensified competition becomes an important goal both at the individual and societal level (Kovačević, 2019). Innovations are essential not only in creating new products and services but also in defining new business processes to achieve faster, more efficient production at the lowest possible costs without compromising the quality of new products. The highly dynamic modern environment leads to various crises caused by economic, political, war, and economic shocks. Crisis periods are characterized by a decrease in market demand, leading to a drop in sales volume, revenue, while costs increase, further reducing financial results. Most companies face liquidity problems and the challenge of maintaining an optimal amount of cash to meet obligations to the state, creditors, suppliers, and employees. Authors who have explored ways for companies to quickly overcome crisis situations agree on the necessity of early crisis detection. In crisis conditions, the ability to quickly adapt to changes and to innovate is of paramount importance. Many countries, aiming to achieve better global competitive positions, recognize the importance of R&D activities in this endeavor and try to steer companies towards R&D through tax reliefs, reduced tax rates, and providing grants for project co-financing, etc. Besides the introduction and conclusion, the paper is divided into three main sections. The first section highlights the importance of R&D activities at the macro level and Serbia's position relative to selected countries in the region and the world in terms of

the percentage of gross domestic product spent on these activities. The second section covers the importance of innovative actions by companies, focusing on one of the fundamental problems, especially for small and medium-sized enterprises, regarding the financing of these activities. The third section addresses one of the Republic of Serbia's incentive measures for conducting R&D activities, reflected in tax reliefs on wages generated from R&D activities. In times of crisis, companies can utilize tax reliefs, thus reducing the cost of R&D activities through savings on taxes and contributions on wages, directly improving their liquidity position. This can enable them to generate innovations through R&D more quickly, potentially allowing them to emerge from a crisis and possibly even use the crisis conditions to gain a competitive edge.

## 2. THE IMPORTANCE OF RESEARCH AND DEVELOPMENT ACTIVITIES AT THE MACRO LEVEL

The impact of knowledge on economic growth was first mentioned in the mid-20th century by the economist Robert Solow, who expanded the growth model with a technological variable. Solow observed that the growth of gross domestic product per capita in the USA during the period from 1909 to 1949 was driven by a 12.5% increase in capital, while the remaining 87.5% was due to technical progress (Kecman, 2016). Solow belonged to the theorists of the neoclassical theory of economic growth, who considered knowledge as a public good (Tomljanović, 2017). Further discussions on the importance of investing in R&D for economic growth emerged in the 1980s and 1990s within the framework of the endogenous economic growth model. Endogenous theorists attributed market characteristics to knowledge, with key features being rivalry and exclusivity (Tomljanović, 2017). Romer stated that an increase in production directly depends on the amount of labor involved in R&D activities (Tomljanović, 2017). Griliches focused on the social rate of return on investments in R&D, stating that the social rates are significantly higher compared to the private rates of return on capital invested in R&D (Kecman, 2016). In today's model of economic growth, innovation plays a primary role and represents a significant factor in sustainable development (Mitrović&Mitrović, 2020). Authors Pecić and Petrović (2022) consider innovations and technologies as the heart of social progress, noting that societal advancement has significantly accelerated with each new invention since the beginning of the world. Countries that best and most quickly adapt to changes through the development of new innovations are also the most successful countries (Filipović, Nikolić & Ilić, 2015). In a highly globalized world with intense competition among nations, individual countries aim to achieve long-term competitiveness through the development of a knowledge-based economy (Filipović et al., 2015). R&D activities play a crucial role in the development of science, technology, and innovations, which are fundamental principles for the growth and development of countries (Jakšić & Trajković, 2023). Recognizing the importance of R&D for gaining a competitive edge, the European Union set a goal with the Lisbon Strategy adopted in 2000 to become the most competitive and dynamic knowledge-based economy in the world by 2010. To achieve this goal, the European Council set a target of investing 3% of the gross domestic product in R&D (Jakšić & Trajković, 2023). Countries with the highest incomes are those that invest the largest percentage of their gross domestic product in R&D (Jakšić & Trajković, 2023).

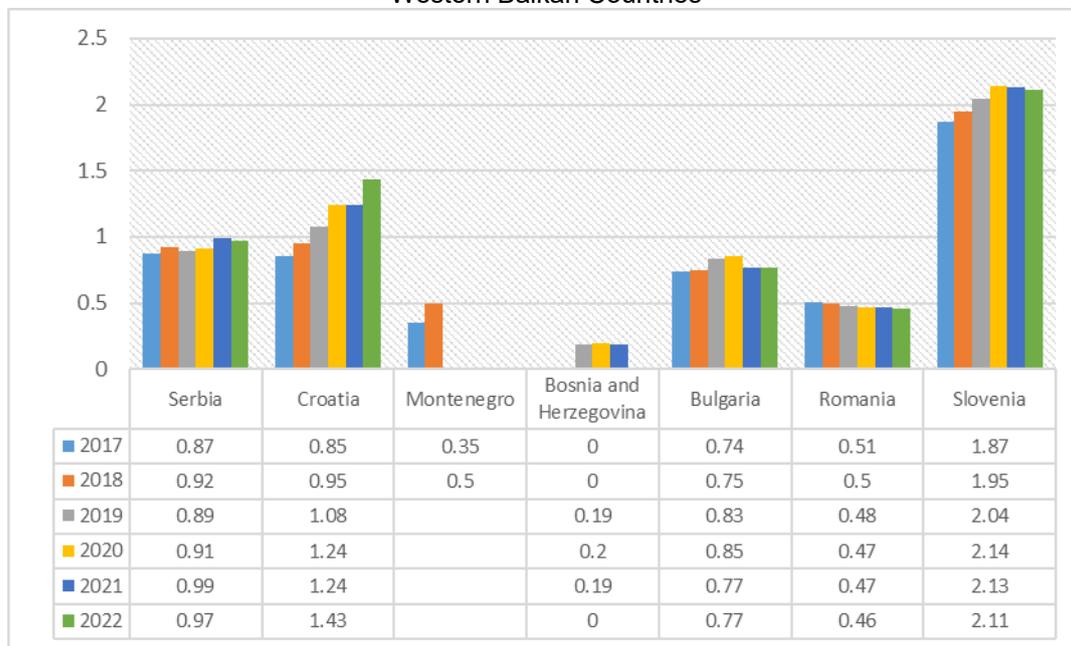
Chart Number 1: Percentage of Research and Development in the GDP Structure in European Union Countries, USA, Japan, and South Korea from 2018 to 2021



Source: Developed by the author based on Eurostat

Some of the most developed countries in the world invest over 3% of their GDP in R&D activities, which makes them global leaders in innovation and holders of long-term competitive advantages among nations. The Council of the European Union has set a target of investing 3% of GDP in R&D activities. Some members, such as Germany, Austria, and Sweden, invest even more than 3%, but certain member countries have significantly lower R&D expenditures, which affects the decrease of this indicator at the level of the European Union and the failure to achieve the target of 3% R&D participation in GDP.

Chart Number 2: Percentage of Research and Development in the GDP Structure in Serbia and Selected Western Balkan Countries



Source: Developed by the author based on Eurostat

The chart shows that Slovenia stands out among the selected surrounding countries with the highest percentage of GDP allocated to R&D activities in all observed periods, followed by Croatia from 2019, while Serbia currently allocates less compared to these two countries but significantly more compared to Bulgaria and Romania. There are no available data for Montenegro and Bosnia and Herzegovina for all selected years, and the available data indicate that these two countries allocate a significantly smaller percentage of GDP to R&D compared to other countries in the region. Authors Jovetić and Janković (2012) conclude that the share of research and development in GDP has a statistically significant impact on the movement of gross domestic product per capita, i.e., if the share of R&D in GDP increases by 1% (decreases by 1%), the gross domestic product per capita will increase (decrease) by about 0.5%. In times of crisis and significant societal challenges, as confirmed by the crisis caused by the COVID-19 pandemic, it is very important for countries to respond quickly through the innovation system to prevent a decline in employment and living standards (Pecić & Petrović, 2022). Considering indicators such as the Global Competitiveness Index, it can be concluded that countries that develop innovative business methods, have highly productive business processes, and possess quality scientific research institutions have reached the highest level of economic development and achieved an enviable competitive position at the global level (Lazić & Markov, 2011). From all the above, it can undoubtedly be concluded that R&D activities are one of the key factors for economic growth, improvement of the competitive position at the global level, and enhancement of the living standards of the population. On the world market, the most competitive countries are those that efficiently utilize the resource of knowledge (Nikolić, Stošković & Cvetanović). A competitive economy operates within a large number of successful companies, where there is full employment and which provides a sustainable high standard of living (Filipović et al., 2015).

### 3. THE IMPORTANCE OF RESEARCH AND DEVELOPMENT ACTIVITIES IN COMBATING CRISIS AT THE COMPANY LEVEL

Companies are forced to think proactively and constantly strive to create innovations to ensure their long-term survival and development. Entities undertake R&D activities to increase their product offerings and improve the efficiency of production processes through cost reduction (Aralica, 2011). Companies rely on innovations because they create new markets and build competitiveness (Pecić & Petrović, 2022). R&D activities, in most cases, require not only an innovation-oriented organizational structure and the engagement of highly competent individuals but also significant financial capital, which companies, especially small and medium-sized enterprises, find increasingly difficult to secure

in crisis conditions. Factors influencing the degree of innovativeness of a company can be grouped into organizational and financial factors (Ravić & Gavrić, 2015). Small and medium-sized enterprises are characterized as the most vital and flexible part of the national economy, with high levels of flexibility, developed entrepreneurial spirit, focus on creativity, absence of rigid regulations and procedures (Ravić & Gavrić, 2015). All these characteristics of small and medium-sized enterprises indicate that they are the most capable in the economy to quickly adapt to changes and pivot towards innovating products, services, and processes, but such companies often lack financial resources for R&D. With an increasing number of participants in the global market and strong competitiveness, no organization can be assured of security and permanence, and the time frames for adapting to changes are becoming shorter (Bečić & Dabić, 2007). In a turbulent business environment, companies may face various conditions that lead to a crisis, manifesting in reduced earning capacities. Besides the challenges brought by global and regional crises, companies can also face significant dangers from their individual crises, i.e., circumstances that lead to the worsening of situations in a particular company. Some early signs of a crisis include a decrease in orders from customers and a loss of market share, which will result in a drop in sales volume, profits, and company liquidity (Pešević, 2013). Successful companies possess methods and tools that allow them to timely recognize a crisis, prevent it, and manage it, resulting in crises occurring less frequently, being of shorter duration, and having milder consequences in such companies (Milojević, 2011). In periods when a company's sales volume drops and its earning capacity decreases, one of the first and biggest problems is maintaining the necessary level of cash to meet obligations, i.e., maintaining an adequate level of liquidity. A liquidity crisis is reflected in a situation where a company is unable to meet its due financial obligations within their due dates or is unable to meet them at all (Pešević, 2013). Identifying the causes of a crisis before its effects become visible is crucial for timely action (Vojnović, Vojnović & Grujić, 2011). Fundamentally, a crisis is considered a danger, but it can also represent an opportunity (Krstić & Krstić, 2016). If a company promptly recognizes the onset of circumstances that may threaten its operations and if it directs all available resources towards improving its processes through innovative activities, not only can it avoid losses, but it can also achieve a competitive position. Competition is one of the primary drivers that compel a company to improve existing products and introduce new ones, and the ability to innovate is a result of learning and development (Milojević, 2011). In contemporary business conditions, innovative action by companies is considered a necessity if they wish to survive in the market and achieve growth and development. Crisis conditions actually highlight the need for R&D, but companies often face a lack of financial resources for R&D in crisis situations, so state assistance can be of great significance.

#### **4. TAX INCENTIVES AS A MOTIVATION FOR CONDUCTING R&D AND A WAY TO IMPROVE LIQUIDITY IN CRISIS SITUATIONS**

A competitive economy operates within a large number of successful companies, where there is full employment and which provides a sustainable high standard of living (Filipović et al., 2015). Governments, in their desire to achieve competitiveness among other countries and due to the positive externalities that R&D activities have on society, decide to introduce various measures such as tax incentives for such activities to further motivate companies to engage in them. Countries wishing to encourage the conduct of research and development activities in companies may also decide to reduce the tax rate on R&D activities. For instance, Belgium introduced a reduced tax rate from 34% to 6.8% for innovation production in 2007, Luxembourg reduced the tax rate from 30.4% to 5.9% in 2008, and the United Kingdom reduced the tax rate from 30% to 24% (Pecić & Petrović, 2022). The Government of the Republic of Serbia strives to support all companies by reducing their fiscal burden in the form of taxes and contributions on wages generated from engaging employees in R&D activities, making it easier for them to decide to conduct R&D as it will reduce the costs of gross wages. In crisis conditions, companies can use these incentives to achieve developmental business goals with lower labor costs, without reducing the number of employees and their net wages, thus remaining a reliable employer. A company crisis can be defined as a process in which the basic economic goals of the company are threatened, including the goal of preserving invested capital, the goal of profitability, and the preservation of liquidity and solvency of the company (Pešević, 2013). Reduced gross wage costs, especially in a crisis situation, affect lower cash outflows from business activities, which certainly improves the liquidity position and frees up funds that can be redirected to meet obligations to other creditors, thus reducing the deterioration of the credit position that often occurs when a company faces a crisis. The effects of an economic crisis are reflected in a decrease in purchasing power, a reduction in demand, increased operating costs, increased business risks, resulting in reduced investments, layoffs, and company closures (Ravić & Gavrić, 2015). In addition to improving liquidity through the conduct of R&D activities, a company can more quickly improve its competitive position. In contemporary conditions, a company's competitiveness should be built on innovations, the development of new ideas, processes, and production processes; innovativeness is one of the most significant factors for the survival, growth, and development of a company (Ravić & Gavrić, 2015). If a company is innovation-oriented and invests resources in R&D activities, it often emerges from a crisis situation much faster than other companies that do not engage in R&D. In addition to the assumption that a company will more easily gain a competitive advantage through research and development, using tax incentives can save significant funds that would otherwise be spent on paying taxes and contributions on wages, as shown in a practical example later in this paper. Article 53z of the Law on Contributions for Mandatory Social Insurance exempts employers who are legal entities and

conduct research and development activities in the territory of the Republic of Serbia from the obligation to pay contributions for mandatory pension and disability insurance for the wages of individuals directly engaged in R&D activities, in the amount of 100% of the obligation, proportional to the time they spend on R&D activities relative to full-time work. Article 21i of the Law on Personal Income Tax exempts the employer-legal entity from the obligation to pay 70% of the calculated and withheld income tax on the wages of individuals engaged in R&D activities, proportional to the time they spend on R&D activities relative to full-time work. The Regulation on the Conditions and Manner of Exercising the Right to Tax Exemption on the Wages of Employees Engaged in Research and Development ("Official Gazette of RS", No. 48/22) specifies the conditions that must be met for a company to enjoy such benefits. According to the Regulation that specifies the manner and conditions for exercising the right to this type of tax incentives, research and development are considered activities "developing new or improving existing production systems and/or products, developing new or improving existing computer circuits, formulating new chemical compounds, developing new or improving existing systems for solving soil and environmental pollution problems, evaluating soil characteristics, conducting laboratory experiments, developing software solutions, developing waste water management systems, developing new or improving existing materials, and similar".

The paper presents an example that will practically demonstrate the significance of tax incentives as a determinant of liquidity in a company. The assumptions guiding the author in creating the example are as follows:

- The employer pays a gross wage of 200,000 Serbian dinars to an employee who was engaged in R&D activities 50% of the working time relative to total working time;
- The amount of the non-taxable part of wages as of January 1, 2024, in the Republic of Serbia is 25,000 Serbian dinars, according to Article 15a, paragraph 2 of the Law on Personal Income Tax;
- Article 44 of the Law on Contributions for Mandatory Social Insurance specifies the percentages from the gross wage that are allocated for pension and disability insurance contributions, health insurance contributions, and unemployment insurance contributions;
- According to Article 16 of the Law on Personal Income Tax, wages are taxed at a rate of 10%;
- The employer separately calculates the part of the wage related to R&D activities and does not pay pension and disability insurance contributions for these activities, neither on behalf of the employee nor the employer, and pays income tax at 30% of the calculated tax on the wage related to R&D activities.

Table 1 Presentation of the calculation of the part of the total gross wage related to activities not considered research and development

Ordinal number	DESCRIPTION	Amount
1	Gross earnings of the employee for research and development work	100,000.00
2	Non-taxable amount (25,000 * 50%)	12,500.00
3	Tax base (Line 1 - Line 2)	87,500.00
4	Income tax (Line 3 * 10%)	8,750.00
5	Base for contributions (Line 1)	100,000.00
6	Contribution for Pension and Disability Insurance (on employee's burden) (Line 5 * 14%)	14,000.00
7	Contribution for Health Insurance (on employee's burden) (Line 5 * 5.15%)	5,150.00
8	Contribution for Unemployment Insurance (on employee's burden) (Line 5 * 0.75%)	750.00
9	Net earnings of the employee	71,350.00
10	Contribution for Pension and Disability Insurance (on employer's burden) (Line 5 * 10%)	10,000.00
11	Contribution for Health Insurance (on employer's burden) (Line 5 * 5.15%)	5,150.00
12	Tax exemption (Line 4 * 70%)	6,125.00
13	Employer-paid income tax (Line 4 - Line 11)	2,625.00
14	Contributions for Pension and Disability Insurance paid by the employer	0.00

Source: Developed by the author

Based on the presented example, we can conclude that the employer will allocate a total of 115,150.00 RSD (line no. 4+line no. 6+line no. 7+line no. 8+line no. 9+line no. 10+line no. 11) for the payment of net salary and all corresponding taxes and contributions on the part of the salary not related to research and development.

Table 2 Presentation of the calculation of a portion of the total gross earnings related to research and development activities

Ordinal number	DESCRIPTION	Amount
1	Gross earnings of the employee for performing other tasks.	100,000.00
2	Non-taxable amount (25,000 * 50%)	12,500.00
3	Tax base (Line 1 - Line 2)	87,500.00
4	Income tax (Line 3 * 10%)	8,750.00
5	Base for contributions (Line 1)	100,000.00
6	Contribution for Pension and Disability Insurance (on employee's burden) (Line 5 * 14%)	14,000.00
7	Contribution for Health Insurance (on employee's burden) (Line 5 * 5.15%)	5,150.00
8	Contribution for Unemployment Insurance (on employee's burden) (Line 5 * 0.75%)	750.00
9	Net earnings of the employee	71,350.00
10	Contribution for Pension and Disability Insurance (on employer's burden) (Line 5 * 10%)	10,000.00
11	Contribution for Health Insurance (on employer's burden) (Line 5 * 5.15%)	5,150.00
12	Tax exemption (Line 4 * 70%)	0.00
13	Employer-paid income tax (Line 4 - Line 11)	8,750.00
14	Contributions for Pension and Disability Insurance paid by the employer	24,000.00

Source: Developed by the author

Based on the presented example, we can conclude that the employer will allocate a total of 85,025.00 RSD (the sum of items with line nos. 7, 8, 9, 11, 13) for the payment of net wages and all associated taxes and contributions for wages related to R&D activities. By comparing these two calculations, we can conclude that the company will have a smaller outflow of funds amounting to 30,125.00 RSD for the part of the wage related to research and development compared to the part of the wage related to tasks not considered as research and development. In other words, the company saved 26% of the total gross wage cost on the portion of the gross wage generated from R&D. If the company had a total gross wage cost for all employees of 20 million RSD and if each employee spent 50% of their working time on research and development, the company would save 2,615,153.00 RSD due to lower paid taxes and contributions on wages just for one month, which could amount to approximately 31.4 million RSD in savings over a year.

## CONCLUSION

R&D, as activities that will result in an innovated or entirely new product, service, or business process, are an inevitability in the business of the modern world, as such activities are one of the key conditions for securing a competitive advantage. The business environment is turbulent and changes rapidly, and companies are expected to be capable of quick reactions. In addition to the significance of innovative processes for companies, countries also want to increase the scope of research and development activities at the national level to secure a competitive advantage over other countries. Besides greater competitiveness, it is considered that a larger scope of research and development influences an increase in the gross domestic product per capita, which certainly affects the improvement of the standard of living in countries that engage more resources for R&D. Governments of countries introduce various programs to encourage companies to invest in R&D, and one way to achieve greater motivation for companies for R&D is through tax incentives on wages paid for engaging in R&D activities. Especially in crisis conditions, it is important for companies to actively work on innovations as it is assumed that this will enable them to overcome crisis situations more quickly, which are primarily reflected in a decrease in demand for their products and services. By using benefits in the form of reduced taxes and contributions on wages, they will also have lower outflows of funds based on wages, allowing them to direct a larger portion of funds towards meeting obligations to other creditors, i.e., improving their liquidity position. The author's intention is to emphasize the importance of R&D activities both at the macro level and at the company level and to interest companies in using the benefits in the form of reduced gross wage costs paid for R&D activities, which can impact the improvement of the company's liquidity position.

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**Miloš Todosijević**PhD student at University of Pristina  
Faculty of Economics in Pristina with temporary  
headquarters in Kosovska Mitrovica  
Novi Sad, Serbia

e-mail m.todosijevic@icloud.com

**Radmilo Todosijević**PhD, Emeritus Professor  
Novi Sad, Serbia

e-mail radmilotodosijevic16@gmail.com

**Sanel Mehmedi**MSc at University of Novi Sad  
Kosovska Mitrovica, Serbia

e-mail sanelmehemdi2@gmail.com

## **CONTEMPORARY CHALLENGES FOR ACCOUNTING AND ENVIRONMENTAL BEHAVIOR**

**Abstract:** Industry 4.0 happened to us. It acquires a dominant role in accounting mosaic. The new accounting philosophy requires continuous reactions and managing changes.

Blockchain and artificial intelligence will affirm new categories in communication relations. The aim of the work: new philosophical views on the causes of change, their recording and digital communication networking; The subject of the work is the micro and macroeconomic part and the social dimension. Hypothesis: the ability to identify digital trends. Auxiliary hypothesis: Recognition of self-benefit.

**Keywords:** accounting, digitization, philosophy, innovation, change

### **1. INTRODUCTION TO THE PHILOSOPHY OF ACCOUNTING**

The world of tomorrow, unfortunately or fortunately, whose appearance is difficult to follow, unequivocally orders "you will perish if you do not adopt our coming truths!?" Christian philosophy - proves that the truths that arise from these knowledge are not against human reason, but that they transcend it. The truth belongs to the public, it exists, independent of our knowledge of it. (Popović J. 1999. p. 16). Theology believes that philosophy is only a stimulus, which reason serves in an effort to express and define what seems incomprehensible to the public. Theology, therefore, does not consider that philosophical thinking reveals the truth - theology interprets, while Gnostics, striving for "spiritual maturity", strive to reach higher truths. Interpretation of the truth is the greatest protection against quasi-truths. Accounting strives to put an equal sign in the relationship between information and truth. We focus on the quality of accounting information and on enabling accounting to follow the achievements of artificial intelligence, as a structural part of the overall technical progress, following the symbiosis of the knowledge-based economy, the evolutionary, digital economy and the complete information structure. At the World Congress of Accountants in Sydney (VCOA 2018), a number of philosophical questions were raised that correspond to modern accounting trends, and we hope that some imposed or acquired misconceptions are gradually eliminated. It is even shown that "the provisions of ancient philosophical discussions are not so far from modern accounting"?. <https://buh.ru/articles/documents/93615/> M.L. Pyatov (Consulted 02/26/2024) Does accounting information reveal the truth? Yes and no! .It is primarily input data. which, as a result, reveals the state of the relationship between the information provider and its user, the content of the information, its structure, time coverage, the list of users, resulting from the established organisational structure and way of functioning of the accounting and information-reporting policy. "Without knowing how and to what extent company incorporated within the branch and economic system of the country, and as it is also organised, the value of the company cannot be reliably estimated". (Mikerević D. Etc., 2021. p. 113) The role of information as a form of public action, reporting and communication, through developmental changes and management

(command) action becomes dominant. Remote work confirms this and affirms digital processes. (Kondić N. Mutić S. 2021. p. 152).

Do risk and uncertainty help the truth? Philosophically and "given that future events are, to a greater or lesser extent, uncertain, business risk is always present, as well as its impact on the company's business results". strategic challenge We need a new philosophy of accounting whose information and decision-making will represent theological confirmation of philosophical truth.

Evolution occurs according to the order of activities, but with technological progress comes the acceleration of the tendencies of evolutionary processes. Accounting as a profession is not immune to technological innovation and digital transformation processes. With the acceleration of the world economy, an era of complexity will come.

We think that the practical accountant and the one who is in the process of learning, would be enriched with accounting wisdom through philosophical expression. (<https://www-audit-it-ru> (27.82023)). Culture, economic thought, views on the world and society, shape their tomorrow. Creative - economic history, is constantly searching for ways of its own functioning. (Girard, R. 1961), (Romantic lie and romantic truth, p. 325. Paris, Grasset, p. 325).

## **2. Economic laws and philosophical attitudes as tracing the future**

Accounting focuses on the generation of information for planning, evaluation and control in organisations, where, in terms of development, it corresponds with scientific and technical achievements. The promotion of economic laws and relations in the functioning of the system are constantly the subject of philosophical research as a specific feedback loop. It is also about the aspiration of "change for the better". Scenarios of the future: general and accompanying, are inconceivable without relation: accounting information-philosophical view of development. The quality of information and wisdom shaped by philosophy will prove to be the main characteristic of potential success. It is confirmed throughout history that philosophical wisdom formed the basis of economic and social movement, because "Economic views are always an element of our general views on the world and our place in it". (Bačinić V.A., 1999. p. 607).

Thus, the concept of economic benefit is an element of the general idea of good. The auditor's code of ethics is based on general ideas about ethics, and an "economic man" is none other than a person who makes economic decisions and performs actions that have certain economic consequences. It is about a person who acts in the context of his psychology, the society he is a part of, his physical capabilities, his apperception, a man who strives for pleasure and avoids suffering, etc., etc. It is important to note that the economic consequences of technological progress are part of what happens to society as a whole due to the development of technologies. Numerous examples can be listed here in a long series.

Our understanding of economics is manifested in the social level of knowledge. It is also an indicator of development. All social sciences are expressed as views on process changes, as types of events on the basis of which the collective opinion of the structure of flows is defined. The political and scientific system and the general culture and religion, law, technology, international relations, etc. influence the currents and set of opinions about them.

Our level of knowledge and attitudes - judgments, are never right or wrong. They only reflect the system of views that prevails in society in a certain historical period. They cannot be evaluated according to the criteria of "correct" and "incorrect", if only because they influence the development of society in a certain way and are reflected in it. (Nenasheva I.A.: <http://e-koncept.ru/2013/53517.htm>). The behaviour of the environment is always unpredictable! As a rule, real forecasts are kept as confidential information, fake ones are broadcast, false hopes are raised, mistrust and changes in negative organisation and actions are broadcast. It is shown that the publication of true forecasts from an economic-philosophical understanding loses all hope. Information has become the first line of weapons (truth - lie) and the first line of wealth (science - knowledge) of the modern world. The new "rich" and the new "poor". Poverty historically persists because greed is sustained and reinforced. The need for balance is constant. The cybernetic balance is disturbed, conflicts are inevitable. Changes will occur in the ways and conditions of business and duration. It is up to accounting to record them, analyse them, distribute them...

## **3. Philosophy, accounting and standards**

In the philosophical sense, information appears as a substrate of the management process. Financial statements are a set of information relevant for decision making. To decide means to manage. Information based on financial reports serves as a basis for analysis, evaluation and definition of decisions on strategies. (Todosijević R. (2010) p. 36-37.) Confirmation and business processes in general and their evaluation define information as a result. The act appears as the subject of the reporting element: assets, liabilities, part of the capital, income, expenditure and money as the subject of confirmation. This is the basis for the principles and rules of accounting, but also the basis of the functioning of the system. Financial results from certain business activities can be presented in financial statements. Please note that costs can be a significant item in the picture of the financial situation.

"The business and financial performance of developing economies is particularly sensitive to economic shocks. Financial markets are shallow, so funding opportunities are narrow and vulnerability to shocks is greater. Insolvency

and illiquidity in such circumstances push companies that cannot adapt quickly towards bankruptcy and liquidation, where the exposure of companies to such risks also depends on their size. The necessity of repositioning accounting in a changed business environment". Malinić D. 2023. p.16.)

"The full set of financial statements in the Republic of Serbia includes the balance sheet, income statement (statement of the total result for the period), cash flow statement, statement of changes in equity and notes to the financial statements" Peštović K. 2023 p. 256)

"The full set of financial reports in the Republic of Serbia includes the balance sheet, income statement (report on the total result for the period), cash flow balance, report on changes in capital and notes to the financial reports" (Kristina Peštović K. 2023 p. 256). "The profitability of the company, regardless of the activity, is the main goal of business. Profitability, as the degree of fertilisation of investments, enables the company to survive more securely on the market, while a higher degree of fertilisation of investments is a prerequisite for the growth and development of the company on the market". Kristina Peštović: " in (2021. p. 308)

The loss as a result changes the image of the state of the business entity. With deferred expenses, the accountant hides losses and presents a false picture of reality. By identifying and evaluating accounting content, we create assumptions for defining scenarios of economic development and the market life of companies, between which there is a feedback loop. Sales and purchases of goods are based on the assumption that the probability of receiving money from customers and paying suppliers will be indicators of the assessment of income and other statements as a result of events. The scenario defines the direction and possible development of activities, and expectations from the future. Events sometimes diverge, but the probability of the outcome of the scenario through the adjustment process must be evident. Science and philosophical approaches often provoke creative strategies and produce new information for selection and use. "As paradoxical as it may seem, all modern financial reports of companies are a set of assessments of the probability of implementing certain scenarios for the development of their activities." (Nenasheva I. A. (2013).

The "philosophy" of modern accounting practice relies on standards. There is rarely a different choice. Ninety percent of the time of a modern bookkeeper in these areas is related to the monitoring and application of tax laws? Frequent changes impose this and reflect the opposite interests of participants in economic relations. Is it possible to treat the interpretation of solvency, liquidity and profitability of the company differently and improve the knowledge about the assets? Is property a value or is it just a prescribed form? The philosophy of the development of accounting throughout history recognises combinatorics that has lasted for several centuries, which is a reflection of the overall development of civilisation. Balance sheets are the backbone of historical transformations, and everything depends on the installed economic system. Historical achievements have been placed through regulations and standards in a determined accounting environment. The philosophy of development is affirmed especially in crisis situations. Strategies that are hungry for prognostic information are sought; reporting - analysis - planning - new information and adaptation through decision-making. (Sokolov Y.V. 1996. 638).

#### **4. Elaboration of some attitudes from the environment**

"Requests for information by shareholders of companies whose main interests were dividends paid out of profits, have significantly changed both the accounting methodology in general and the treatment of assets in particular. The value expression of the property represents the accounting index of the ontological content and its inventory. The basis for forming the company's balance sheet was the idea of capital circulation, and assets began to be understood as a set of investments (expenses), from which income can be expected in the future. This changed both the composition of assets (it began to include positions that do not reflect assets owned by the company) and their assessment - its basis was cost prices or historical prices (the amount of actual costs for the formation of the corresponding asset element)" Nenasheva I. (2013 ).A. URL: <http://e-koncept.ru/2013/>.

The basic philosophical meaning of accounting has not changed over the centuries, regardless of the method of data processing, but the capabilities of the accounting information system supported by computer data processing have greatly facilitated the performance of a large number of accounting tasks. Security, reliability, timeliness, accuracy, as an information product in real time becomes and proves to be the main component of the decision-making process. Todosijević Lazović S. (2020). p. 81 -82.). Accounting cyber balance protects us from errors associated with the literal perception of some analytical indicators calculated according to the balance sheet, and on the other hand, it creates wide possibilities of informational influence on the users of financial statements. In connection with our views, we point out that technological achievements and, in this sense, accounting promises, were the subject of the World Accounting Congress in 2018. Depending on the achievements of civilization, the concept of accounting philosophy was changed and modernized. Ultimately, we are convinced, digitization will abolish the market, just as the market abolished feudalism. In the philosophical sense, caution is never enough, because its protagonists, on the other side of reality, never stand still, and there are cyberists as well as deviations of the mind, which the recent history of civilizations and its present confirm. Wiener's prediction, (Wiener N.1972 p. 3-5 creator of cybernetics, that the greatest danger to humanity will be the concentration of power of the media and media assets, concentrated in the ownership of a small number of rich people) has been realized and is increasing. The book Cybernetics...was written before the Second of the World War, long kept as a military secret. Institutes for the production and distribution of lies are being established,

modernized, and are ruthless in their actions. We state these "sick" trends, because we believe that accounting is not on the side of civilizational trends, and unfortunately it is forced to follow "changes without cover". When the profession follows social deviations, these same deviations are reflected in it.

"Besides the technical jargon of counting and writing, what else can be said about accounting and its philosophical exploration into the world of trust? To count, is to include evidence that the goods, by ownership and management, as a function of value and fidelity should be what they are. The "Information Factory" defines the directions of supporting documents to assign, entrust property in accordance with the purpose of the interest, as a result of the acquisition and as material evidence that the field of interest expands over time, but also the individual interest of the one for whom the account is taken. (Bouchard B. (2014).

Law and accounting form a symbiosis with a philosophical view, and the same applies to the relationship between the balance of income and the interests of society. Accounting, law, Luka Pacioli, international coat of arms of accountants, Themis as a symbol of law and order, chart of accounts, accounting accounts, double-entry bookkeeping, economic analysis of law, etc. they represent and affirm the achievements of philosophy. (Todosijević R&Lazović S. (2022) Forensic accounting, scientifically, professionally and legislatively, is developing. "The consequences of fraudulent actions are enormous. According to research by the International Association of Certified Investigators (ACFE), companies lose five percent of their revenue annually due to fraud, while the value of the average 1.78 million dollars of fraud. The number of lost cases, as well as the number of unsolved crimes, is extremely high, and the costs incurred by the state as a result significantly burden the budget. In this sense, forensic accounting can contribute to the improvement of the work of public institutions, the prosecution, and the police, judicial authorities and thereby strengthen citizens' trust in their efficiency." (Malinić D.2023) A philosophical approach based on the synthesis of knowledge of the interdisciplinary nature of the relationship between accounting and legal phenomena is emerging, which enables a philosophical approach based on an interdisciplinary synthesis of knowledge, based on "pure opinion, focused on the most important issues of being, freed from all insignificant or studied events" (Bačinin V.A1999. 607). Educated people are the ones who can change the rules of the economic and social system simply based on their ideas about those rules" (Kontić, Lj. (2018. 233-251).

The first attempts to calculate the economic effect in various fields of activity and to solve problems related to property protection date back to the 5th century. BC with the transition from natural exchange to commodity-money relations. (Todosijević Lazović S. (2020 p. 119-121) The moment, when the extraction of profit in the system of economic relations becomes a real motivating fact, the objects of research will be reflected in financial and legal doctrine and practice. The topics are: economic benefit and effect, rational selection, reasonable redistribution and consumption of natural resources as legal definitions and economic categories in interconnectedness and inseparable unity, with careful, rational use of resource potential as a natural good.

## 5. Case study - some indicators on the example of company "X"

Telekom Srbija offers available solutions for all companies that need a business system with which they can issue orders, invoices, monitor warehouses, manage accounting, manage salaries, plan production, or manage business processes. <https://www.dataexpert.rs> (consulted on April 29, 2024). Methodologically, we set up an ex post analysis, derived the following indicators as projections for the ex ante position with a forecast confidence interval: indicators of financing: level of own financing 30 to 52%; indebtedness indicators 55 - 70%; coverage (first degree 70 to 100%; second degree at least 100%; liquidity indicators such as ability to pay: we think 70-100% is enough. A lower degree of liquidity is also possible depending on the level of cash. The standard is that "the current share has values in the interval from 100 to 120%. The financial position of the company gains importance by analyzing the indicators. A lower degree of liquidity is possible when the company has unexhausted credit limits. For small and medium-sized companies, liquidity is the most important indicator. The quality of the management is confirmed by the results of the achieved goals. At the center of every company's business is the profit and cost centrality. The emphasis was on the reduction of costs and on the more effective use of cash flow. of (monetary) funds. The correct interpretation is very important: the indicator must refer to quantities that can be compared. How to help business by applying IT technologies and artificial intelligence. : Cost Control; Availability; Legal Compliance; Prepared documents and reports: <https://www.dataexpert.rs> consulted on April 29, 2024). The most important advantages for bookkeepers and accountants: <https://www.dataexpert.rs> consulted 04/29/2024). Simplified cooperation; task automation; accounting consoles; document exchange with clients; Full insight into the customer base and time spent report for each one etc. With software as a service in the cloud, it is much easier to remove the burden of unnecessary architecture, which was previously necessary to manage and run a business.

## 6. Some observations about interrelationships in society

Digitization of accounting activity through automation will update its analytical reporting part to real time, and will create prerequisites for the penetration of new philosophical understandings, which confirms the position that this area cannot be bypassed from the position of progress and its universal diffusion.

Corporate reporting becomes a function of technological capabilities that provide the ability to individually create data flows, according to the dynamics of change. This position corresponds to the position that "economic openness" is based on two dimensions: the first dimension is "real or financial and the second, reports that define the measure of "openness" (Markić M. Markić B. 2023, p. 224). Under the influence of information technologies, the leading role of accountants in technologically literate societies will be formed. Economic and social development will affirm a new management and reporting philosophy. The degree of complexity and functioning of the system is increasing, which is contributed by globalization, so it is also a challenge to react and create a defense mechanism. The geopolitical semantic space imposes a diversified view of the accountant of the owner of information, as a function of economic decisions. Philosophy makes it possible, as a forecast, to understand these decisions.

The vector of efficiency as an "instrument of prudence" and economic analysis form the basis of development in the future, as well as the quality of being. (Sokolov Я.V.: 1996 p. 638). Law, accounting, philosophical doctrine and cybernetics interact with nature and society (evolution). The right moment has arrived to change the paradigm of society and the system structure existing in it. The mass market is on its way. Advertising, advertising, order, pay, download, ask, read the manual if you can, control, advertise, litigate, think, expensive, cheap, stop, hurry, arrive, phone, deadlines, duration, guarantee, Belgium, own autopilot... Phraseology the same questions continue in a circle. (Girard, R. (1961) Trends arise, reactions are forced or innovatively programmed, the way of thinking and reacting changes. From the weight of resistance or the speed of acceptance, the degree of destructive or destructive performance and the effect of progress in the profession and society depends ([https:// www-audit—it-ru](https://www-audit-it-ru)).

By affirming values and defining goals, choosing new communication channels and quality of reporting, prerequisites are created for broadcasting values, knowledge, interpretation and ways of using them. By converting the value, the price acquires dimensions of responsiveness. The language of accounting is a reflection of the level of knowledge and professionalism. International accounting standards created the basis for new philosophical considerations of things and processes. Uncritical takeover, (for the sake of flattery) diminishes one's own creative ability both on the level of legislation and on the level of management of accounting information.

Please note that the truthfulness of accounting information is not only the responsibility of the accountant, but also of all actors in the process of creating and using it. FTAF(2019) issued recommendations, which may feature standards for controlling money flows (laundering), financing of terrorism and the proliferation of production and trade in weapons of mass destruction. FTAF (2019). Illegal activities require a legal response from the state and accounting. The facts are complicated, because states sometimes sponsor these activities.

"The addressees of annual financial reports under German commercial law are shareholders and creditors as equal interest groups. The Tax Administration constitutes the third group of interested parties according to the principle of jurisdiction of the commercial balance for the tax balance. In Great Britain, on the other hand, there is only one main interest, the investor community" (Tanberger F.. (2001). The principle of continuity applies to both systems. The principle of continuity essentially corresponds to the "concept of consistency" There is a distortion in the direction of the tax law in terms of objective informational functions. The general norm is not generalizable, which is the basis of other rules. The attempt to compromise between creditors, shareholders and the tax administration is only partially fair and true only from a tax point of view. The question of the relationship between education and economic growth remains controversial, both in theory and in empirical literature. Agić, Z. 2018. .

## 7. Future challenges - asset recording directives

Accounting assumes an ontology of human understanding of property. as the set of assets that it constitutes. To have is a thing in itself; what fulfills us; what makes us brave; to have is something that is there, in our mental space, in our head. . ([https://www-audit--it-ru](https://www-audit-it-ru)

Man continuously defines needs, which are sometimes countless and projects are multiple. Hesitation can be seen as a search for choices and the right information to make a decision. The degree of maturity manifests itself as a synthesis of many masses of knowledge, culture and skills, but also the incompleteness of one's individual existence. Nothing has such sensitive sensors as capital, it unfailingly goes where it can be increased. The constant point of accounting in motion is the account, known as the shareholder's capital, that is, the capital account, the account that aggregates and synthesizes all the others in the expression of a single value - a number, according to Bouchard B.u, De la confiance comptable : vers un regard dérobé, oublié. (You have to change your life).

Accounting statements may be a function of devaluing the ontology of renunciation in favor of an ontology of empowerment and survival. However, ensuring daily survival is a function of the goal that strives for further capitalization and increased calculation of results. (Sloterdijk P. 2011) Accounting trust is an exponent of the truth between two people, the truth of vitality, anthropometry, which defines the position of the relationship.

The difference between archiving and writing should be understood because accounting is a form of practical knowledge that is given, first of all, to be "seen", since for him "man is a figure of history" - memory. The very concept

of the "presence" of the other in the transaction, translated into an accounting entry, contains the need for sympathy in trust, which can therefore only be read by saying "we", before reading in intimacy for "me" itself.

Asking what this accounting of capital can be used for, we understand that it participates in the search for one's own and that, not personal fulfillment, the maintenance of heightened individualism or narcissism, not for oneself, but for the archeology of the intimate. It's a chase, a climb up the ladder of the home country. As a result, it is only in this area that there are no more disagreements that hold together. A rational attitude in reporting eliminates currency, because it belongs to the means, among other things, to justify the unjustified. A chartered accountant compiles an epitome of what is invisible, to find out what a self-employed person does not want to do. You don't have to think about anything. Consistency with non-speaking figures has been achieved. The characterology of all participants in shaping information is under review.

Finally, any discourse on expertise, accounting, and trust, any other form of epistemological authority, is only the other end, a peculiar rupture with the ontological intensity of the self-owner and its unpredictable ups and downs. Epistemological authority remains the assumption of virtual comprehensibility of accounting information, whatever form and type of reporting it may be. The goal is to get to primitive sources as soon as possible, at least in the place of an accountant, to one's own money. It is difficult to make a return to the previous state. Industry 4.0 happened to us; It confirms the dominant role in the mosaic of accounting for companies and in general for independent business entities. We need a new accounting philosophy, because digital innovation requires continuous response and change management. It is crucial that accounting information defines the forms of reports and statements, and their preparation remains the responsibility of those parts of accounting from which these reports originate. It is an intermediary that, through the design of the assortment of information, the form and content of individual statements and reports, mediates between the users of that information and the part of accounting that prepares the information. It is always necessary to take all measures that contribute to the efficiency and effectiveness of processes and expectations in terms of communication. On stage is the basic production philosophy of "cost-benefit" and "no inventory" in real time, except when inflation is over 150%. For the purposes of management, accounting information profiled with new purposes was created, and for their creation, new parts of accounting were created. Accounting and financial planning was established for the purposes of future planning. Technological scientific prediction can predict only a part or a segment of the future course of events. Technology represents implemented knowledge, through algorithmization and analogy with the biological world designed in the function of human well-being. We need not less knowledge but more knowledge, not less technology but more technology. Real-time location tracking can be used to monitor the location of moving assets inside and outside a business facility. On the other hand, combined with IoT functionality, artificial intelligence could become the "brain" that controls entire production facilities" Krstić L, Krstić M. 2018) p.121) Strategic cost management can be used as a philosophy to ensure competitive business strategies. Kovjanić M. 2013) Information technologies and digitization do not determine the future of accounting. They appear as a temporal tendency and as an aid for self-projecting the future in the purpose of its purpose. (<http://www.hanfa.hr/> 12.08.2019. Accounting is a discipline that is learned. Artificial intelligence, blockchain, mobility, digital transformation, evident technological progress, will lead to the fact that many jobs will be transformed and disappear, but also, following the sequence of evolutionary events, new professions, unknown to us today, will be created in order to realize the adaptation process. economic and social flows with new operating conditions. Cloud infrastructure can host and archive thousands and thousands of accounting documents and make them available at any time, from any type of terminal. Technology that is constantly advancing and being perfected introduces us to the new 5G mobile network, where everything will be fast and even faster, better quality, simpler, more operational, more accessible.

With every innovative breakthrough comes the double action of technical progress. At the same time, it affirms creative innovation and the affirmation of the results of scientific and technical technological research, and on the other hand, it devalues existing products, techniques, technology, and knowledge. There is no absolute progress without relative regression. With each action from the innovation environment on the business system, depending on the strength of resistance, the destructive effect of progress will be stronger. (Newton's first law). The state of stability is being disrupted by the force of the attack from the innovative sector. New technology involves not only new production or administrative equipment and procedures. Robotics, telecommunications and computer united, they created information technologies and together they brought digitization and artificial intelligence which is already in our home. It is important to point out that technical and technological improvements have affirmed both managerial techniques and organizations. Changes in management or organization are necessary for the successful introduction of new technologies. Himezie A.B. Osigweh Yg. And Segala M. (1991 p.262) The relationship between new production and business technologies and progress in managerial technology is opposed by technological determinism. The greater the resistance to change, the greater the destructive power. There is no absolute progress without relative regression. New technologies affirm the new but also devalue the existing ones. Graduality is a function of cybernetic balance.

Development processes, of any kind, are gradual and continuous, rarely, except for epoch-making discoveries and the speed of their application, sudden. All emerging changes, of an interdisciplinary nature, financial or non-financial, material or immaterial, must be recorded. Derived states can be positive or negative. The outcome of the changes is communicated through financial reporting. This reporting is a controlling, self-organizing, adaptable, but also confirming factor of innovative business activities. Financial and non-financial information through indicators on assets, liabilities, flows of business activities, research and development costs as previously financed activities, are the basis for investment and development decision-making and are the basis risk control but also the sustainability of positive business. Reporting entities, through the integration of corporate reporting on financial performance, as a rule,

focus on the totality of changes in business and development processes. Digital change, especially the new technological development of industry 4.0, will represent a good contribution to specific topics such as environmental engineering, smart city, e-health, industry 4.0, and mobilization in terms of sectoral, intra-enterprise and external cooperation. Today, it is possible to communicatively network various biological, social, industrial and generally technical, technological and organizational processes that cooperate with each other in their diversity. Industry 4.0. is there, and the question of digital Darwinism and evolutionary integrations does not arise, starting from the fact that absolute interaction functions in natural and social systems. (Rey F., 2018) p. 36-41). "An artificial intelligence algorithm is a complex set of rules that drive artificial intelligence programs, determining their steps and their ability to learn. It is an extended subset of machine learning that tells a computer how to learn to work on its own.". Krsmanović B. 2023. p. 133). Recognition as a human characteristic is immanent in artificial intelligence. Business cloud solutions allow companies of all sizes to offer solutions that are very affordable. "With software-as-a-service in the cloud, it's much easier to remove the burden of unnecessary architecture, which was previously necessary to manage and run a business, and often resulted in excessive workloads and limited downtime. In the end, the overall development process becomes much cheaper. Communication with clients has become desirable for accountants. <https://nardus.mpn.gov.rs/bitstream/id/66083/Disertacija.pdf> The issue of performance management is important for all companies, regardless of their activity or geographical area, but it is especially affirmed with the growth of the company and its development. "Kovačević B. R., 2019 p.1)

Artificial intelligence is not in front of us, it is already in our house. Unlike the historical gradualism in the development of mechanical, energy and information technology, artificial intelligence is characterized by an acceleration of the speed of acceleration (the third derivative of the velocity vector).

## 8. Discussion

We make an analogy with the "trust economy" and the role of corporate reporting, which was born out by the attitude of Philip Dikhoner, that the "friendly" visual content of new types of corporate reporting can represent forgery and fraud if the report is used by insufficiently trained people. Internet information and suggestive orientation as a rule produces trust without coverage. According to the nature of their existence, "people strive for knowledge" we have the attitude of Aristotle in "Metaphysics". The focus of the entire work is the responsiveness of accounting to digital challenges, and we pointed out the social dimension of new communication relationships. Information and digital trends carry assumptions of future benefits. Digital transformation will create conditions for efficient software management. Intelligent algorithms will, as a rule, continue the development of existing systems, but of course this requires that it be socially controlled. Our position on the desired coming truth would be: "social peace in intellectual capitalism". We need a new philosophy as a confirmatory accounting truth, a new value matrix and a new management system. Orientation is the result, whereby we consider the result as a collective social dimension and profit as an interest - usually individual. New technologies affirm new knowledge but also new people. The changes will be sectoral and in names. With the devaluation of the existing accounting professions, new, more challenging, more content, more valued, highly rated ones will be established.

Under the influence of information technologies, the leading role of accountants in technologically literate societies will be formed, while economic and social development will affirm a new philosophy of management and reporting. Robotization and automation are the result of computerization and digitalization, while the future of the profession will be marked by educational and informational digital processes. The outlook for accounting practice is quite steady and dynamically speaking, promising. The academic picture of accounting's future offers a reason for optimism. In the conclusions, we presented prognostic assumptions as an expectation.

## Conclusions

The public, thanks to financial and non-financial information and science, are always corrective factors in the functioning of a system, so because of this fact, information and reporting gain special importance. In the paper, we point to the growing number of companies that regularly inform the public about the sustainability of their operations, which is followed by the growing number of countries that foster such a practice through their legislation (Rey F., 2018. pp.36-41).

Evolution occurs according to the order of activities, but with technological progress comes the acceleration of evolutionary processes. Accounting as a profession is not immune to technological innovations and digital transformation processes. With the acceleration of the world economy, an era of complexity will come.

By the fact that the accounting system affirms through the organization of information circulation, feedback loops, in the communication relationship, the structures that make it up, we actually acknowledge and confirm that accounting is a cyber system. The accounting information system, as a subsystem of the company's integral information system, is not only correlated, but also determined by other subsystems of the integral information system, with which, as a whole, it is a compatible information system. (Todosijević Lazović S. 2021 p.86). All digital and development processes in

general follow the laws of penetration of scientific and technical progress. Its dual effect is manifested both creatively and destructively. Not only does it affirm the new and devalue the old, but the new can also be destructive if the function of human humanities is betrayed. Changes in the direction of management of complex dynamic systems will take place under the influence of the ability to accept innovative achievements in terms of digitization, robotization and artificial intelligence. Transformational processes will be a function of the ability to respond to change. (Todosijević R. 2010) Social sciences should form interdisciplinary research teams, so that the profession can react "ex ante". The demand for accountants will grow in accordance with the evolutionary laws of the development of the profession. Intellectual capitalism and the power of the mind will be in symbiosis, cybernetics at work, the balance must be preserved. One's own independent development is the greatest protection against globalist greed, which is a condition for the system to last and survive. The possibility of flexible performance is created as a distinct advantage of the affirmation of cloud accounting and digital Darwinism. From a security perspective, cloud accounting does not broadcast information like account data. Response and password open them.

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### **Miloš Grujić**

Independent University of Banja Luka  
 Faculty of Economics  
 Banja Luka, Bosnia and Herzegovina

milos.grujic@nubl.org

### **Željko Vojinović**

University of Novi Sad Faculty of Economics  
 in Subotica Department of Finance and  
 Accounting  
 Subotica, Serbia  
 zeljko.vojinovic@ef.uns.ac.rs

## **ESG REPORTING IN CRISIS CIRCUMSTANCES: READINESS AND OBSTACLES OF ACCOUNTANTS IN BIH**

**Abstract:** Global crises like pandemics and geopolitical turbulence have underscored the importance of responsible business practices and corporate transparency. In light of these circumstances, ESG reporting, which measures and expresses a company's concern for the environment, society, and transparent management, has become increasingly crucial. However, in challenging environments with limited resources, such as Bosnia and Herzegovina (BiH), adopting ESG reporting can present significant barriers to the accounting profession.

Therefore, this paper aims to examine accountants' readiness in BiH to adopt ESG reporting under such circumstances. To achieve this goal, we surveyed a representative sample of 290 accountants from across BiH. The survey used a Likert scale to assess accountants' knowledge of ESG standards, their willingness to adopt different reporting methods, and their expectations regarding the impact of ESG reporting on their work, responsibilities, long-term career prospects, and professional development. Data analysis included descriptive statistics, ANOVA tests and t-tests in Excel and SPSS programs.

Our study provides valuable insights into the readiness of accountants for ESG reporting, the measures necessary to support its implementation, and the impact of ESG on the development of the accounting profession in BiH. The study also discusses the role accountants can play in encouraging ESG reporting and answers questions about ESG standards' challenges and how accountants can prepare for their adoption.

Our results demonstrate that the majority of accountants in BiH support ESG reporting, but they lack the necessary knowledge, tools, and resources to properly implement the new requirements. Hence, we strongly recommend taking measures to improve the preparation of accountants for ESG reporting.

It is important to note, however, that the findings of the study may not necessarily apply to other countries or regions, and the use of a Likert scale may limit the precision of measuring attitudes.

**Keywords:** ESG reporting, accounting, accountants

## **1. INTRODUCTION**

Accounting is undergoing a period of significant transformation driven by digitalization (Berikol & Killi, 2021; Gonçalves et al, 2022; Yigitbasioglu et al, 2023). Emerging technologies like artificial intelligence, data analytics, and blockchain are fundamentally changing how accounting tasks are performed and services are delivered (Qasim & Kharbat, 2020). This trend has important implications for the accounting profession, requiring accountants to adapt to new realities and develop new skillsets and knowledge.

This research investigates the awareness of Environmental, Social, and Governance (ESG) standards among accountants in Bosnia and Herzegovina (BiH), their readiness to adopt ESG reporting, and the anticipated impact on the role and responsibilities of accountants, as well as their long-term career development. Within this context, the paper analyzes the key challenges, opportunities, and limitations in performing accounting tasks, alongside exploring how accountants in BiH are adapting to these new demands. The central focus is on the influence of ESG reporting requirements on the work of accountants in BiH and the necessary new skills and knowledge for BiH accountants. In

this regard, the development of new and innovative accounting services in BiH in the digital era and the adaptation of the accounting profession in BiH to these new requirements are examined.

This research aims to assess and analyze the impact of ESG reporting requirements on accounting practices in Bosnia and Herzegovina. It further seeks to provide insights into the challenges, opportunities, and limitations experienced by accountants in BiH during this process.

The central research question guiding this study is: "How can the awareness of ESG standards and the readiness to adopt ESG reporting reshape the way accounting operates in Bosnia and Herzegovina?"

Undoubtedly, there are significant barriers and challenges for accountants in BiH in adopting new requirements, tools, and technologies. Consequently, new skills and knowledge are necessary for BiH accountants. However, by acquiring new skill sets, accountants can offer new services to regulators and clients as the accounting profession in BiH adapts to this transformation.

## 2. LITERATURE REVIEW

The adoption of ESG standards offers several advantages for accountants and their organizations. Primarily, embracing ESG standards empowers organizations to provide a broader picture of their business performance (Raghavan, 2022). Furthermore, ESG standards assist organizations in identifying, measuring, and managing risks stemming from factors like environmental protection, social issues, and governance (Karwowski & Raulinajtys-Grzybek, 2021).

In recent years, a growing number of investors are focused on companies' ESG performance when making investment decisions (Yang & Han, 2023). Consequently, adopting ESG standards allows organizations to access a wider pool of investment opportunities and attract investors who value companies with strong ESG practices (Sun, Wang, Wang, & Sun, 2023). Operating in alignment with ESG standards presents a higher likelihood of long-term sustainability. Effective management of ESG aspects, alongside good corporate governance, reduces reputational risks, legal and regulatory risks, and improves the organization's long-term capacity for success (Lei & Yu, 2023).

ESG standards can aid organizations in gaining and retaining trust and reputation with all stakeholders and within the market (Tsang, Frost, & Cao, 2023). Accountants involved in the adoption of ESG standards can play a crucial role in monitoring and reporting on ESG performance, which helps build investor or owner confidence in the company. Ultimately, embracing ESG standards incentivizes organizations to better manage their resources, including energy, materials, and workforce, which can lead to cost savings and more efficient resource utilization, contributing to the company's improved financial performance in the long run (Peng, Chen, & Li, 2023).

However, ESG standards also present certain challenges for accountants. Firstly, ESG standards necessitate the collection and measurement of data not traditionally captured within accounting systems, encompassing data on environmental, social, and governance aspects of operations (Chopra et al., 2024).

Secondly, ESG standards are not yet fully standardized (Luo & Tang, 2023), and there exist numerous different initiatives, guidelines, and frameworks used in various regions. This situation can create confusion and challenges in adhering to relevant regulations and guidelines. Additionally, integrating ESG standards into financial reporting requires adjustments to existing accounting practices (Cort & Esty, 2020; Tettamanzi et al., 2022). This process may involve changes in data recognition, measurement, and reporting to reflect the ESG dimensions.

Furthermore, ESG standards demand accountants with specific knowledge in the area of sustainability and social responsibility. Accountants would benefit from acquiring additional qualifications and educating themselves on ESG issues to ensure proper application of the standards and provide the necessary information (Hoang, 2018). Subsequently, these standards necessitate monitoring changes in business practices and reporting on them regularly. Therefore, accountants need to be able to track developments and ensure consistent, accurate, and transparent reporting following ESG standards.

In light of the aforementioned, continuous education, keeping abreast of regulatory changes, and integrating ESG standards into accounting and reporting systems are crucial for accountants to prepare for the adoption of ESG standards.

In conclusion, the evidence suggests that accountants can play a pivotal role in promoting ESG reporting by establishing reporting standards, integrating ESG into financial reporting, and providing timely and high-quality information. The adoption of ESG standards presents numerous advantages for accountants and organizations, including enhanced transparency, risk management, investment opportunities, long-term sustainability, corporate reputation, and resource management.

## 3. METHODOLOGY

The research was conducted using an online survey distributed to accountants in Bosnia and Herzegovina. A sample of 290 accountants, representing diverse genders, work experience levels, and ages, participated in the survey. The survey instrument contained questions regarding accountants' attitudes and perceptions towards the implementation and reporting of ESG standards. Descriptive statistics were employed to characterize the data, and statistical hypotheses were tested using t-tests and ANOVA.

The sample in this study comprised 176 females and 114 males, primarily from Bosnia and Herzegovina. The respondents' ages ranged from 19 to 62 years, with an average age of 43.25 years and a median age of 46 years. The majority of respondents (over 53.5%) possessed at least 20 years of work experience, with a significant portion (30.7%) boasting over 30 years of experience. In terms of educational background, nearly all respondents (263) held a "Visoka stručna sprema" (VSS), signifying a high level of education within the sample. The largest group of respondents worked in large companies (139), followed by those working in medium-sized companies (118). This sample, considering factors like age, experience, education, and company size, provides a rich environment for investigating accountants' attitudes and perceptions towards digital transformation within their profession. A five-point Likert scale was used to assess attitudes, with response options ranging from "strongly disagree" to "strongly agree."

### Hypotheses

Based on the aforementioned information, the following hypotheses were established:

Hypotheses on Awareness of ESG Reporting:

H1: Accountants in BiH believe they lack sufficient knowledge regarding the concept of ESG reporting.

H2: Accountants in BiH are not familiar with the major standards and frameworks for ESG reporting.

Hypotheses on Readiness for Adopting ESG Reporting:

H3: Accountants in BiH are not prepared to actively participate in the process of adopting ESG reporting.

H4: Accountants in BiH perceive themselves as currently lacking the necessary skills and knowledge to work effectively with ESG reporting.

Hypotheses on the Impact of ESG Reporting on Role, Career, and Development:

H5: Accountants in BiH anticipate that their roles and responsibilities will significantly change following the implementation of ESG reporting.

H6: Accountants in BiH believe ESG reporting will have a long-term positive impact on their careers.

H7: Accountants in BiH view ESG reporting as presenting significant opportunities for their professional development.

Hypotheses on Predicting the Future of the Profession:

H8: Accountants in BiH expect the accounting profession to offer new services and consulting activities to clients in the future.

H9: Accountants in BiH foresee numerous obstacles in the development of the accounting profession in the near future.

## 4. RESULTS AND DISCUSSION

Answers obtained were first processed according to the gender of the respondents (Table 1).

**Table 1:** Answers to the questions according to the sex of the respondents

Question	P o l N	M e a n	Std . D e v i a t i o n	St d. E r r o r	Conf i d e n c e i n t e r v a l (0.05)	95% Confidence Interval for Mean Lower Bound	95% Confidence Interval for Mean Upper Bound
<b>1. I am fully familiar with the concept of ESG reporting.</b>	<b>F</b>	176	2,489	1,639	0,124	0,85	4,13
	<b>M</b>	114	2,193	1,573	0,147	0,62	3,77
	<b>T o t a l</b>	290	2,341	1,614	0,099	0,76	3,99

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<b>2. Do I know the main standards and frameworks for ESG reporting (Global Reporting Initiative, Sustainability Accounting Standards Board, Task Force on Climate-Related Disclosures)?</b>	F	176	1,216	0,708	0,053	0,10	0,51	1,92
	M	114	1,140	0,396	0,037	0,07	0,74	1,54
	T o t a l	290	2,356	0,604	0,035	0,07	0,58	1,79
<b>3. I am fully ready to actively participate in the process of adopting ESG reporting.</b>	F	176	3,824	1,291	0,097	0,19	2,53	5,11
	M	114	4,140	1,296	0,121	0,24	2,84	5,44
	T o t a l	290	7,964	2,587	0,076	0,15	2,65	5,25
<b>4. My current skills and knowledge are fully sufficient to work effectively with ESG reporting.</b>	F	176	3,898	1,233	0,093	0,18	2,66	5,13
	M	114	4,307	1,074	0,101	0,20	3,23	5,38
	T o t a l	290	8,205	2,307	0,070	0,14	2,87	5,24

<b>5. I expect my role and responsibilities to change significantly after the implementation of ESG reporting?</b>	<b>F</b>	176	4,381	0,899	0,068	0,13	3,48	5,28
	<b>M</b>	114	4,491	0,962	0,090	0,18	3,53	5,45
	<b>T o t a l</b>	290	4,424	0,923	0,054	0,11	3,50	5,35
<b>6. Do I think ESG reporting will have a long-term positive impact on my career?</b>	<b>F</b>	176	2,506	1,663	0,125	0,25	0,84	4,17
	<b>M</b>	114	2,640	1,786	0,167	0,33	0,85	4,43
	<b>T o t a l</b>	290	2,559	1,707	0,100	0,20	0,85	4,27
<b>7. I expect great opportunities for professional development related to ESG reporting.</b>	<b>F</b>	176	3,131	1,642	0,124	0,24	1,49	4,77
	<b>M</b>	114	3,509	1,705	0,160	0,31	1,80	5,21
	<b>T o t a l</b>	290	3,227	1,672	0,098	0,19	1,61	4,95

<b>8. I expect that accountants will offer new services and advisory activities to their clients in the future.</b>	<b>F</b>	1,766	4,057	0,057	0,057	0,11	3,31	4,82
	<b>M</b>	1,144	3,956	0,757	0,071	0,14	3,20	4,71
	<b>T o t a l</b>	2,910	4,013	0,756	0,044	0,09	3,26	4,78
<b>9. Soon (within the next five years), I expect numerous obstacles in the field of the accounting profession</b>	<b>F</b>	1,766	3,028	1,061	0,080	0,16	1,97	4,09
	<b>M</b>	1,144	3,128	1,161	0,109	0,21	1,87	4,19
	<b>T o t a l</b>	2,910	2,996	1,099	0,065	0,13	1,89	4,08

Source: Authors.

The ANOVA test indicates a statistically significant difference in mean response values between men and women ( $F(1, 288) = 5.094, p < 0.05$ ). Women in the project had a higher rating (2,489) than men (2,193).

The ANOVA test indicates a statistically significant difference in mean response values between men and women ( $F(1, 288) = 4.179, p < 0.05$ ). Women in the project had a higher rating (1,216) than men (1,140). Both groups generally believe that they do not know the standards and frameworks for ESG reporting.

Men are ready to actively participate in the process of adopting ESG reporting (3.81 vs. 4.14) but the ANOVA test does not indicate a statistically significant difference in mean response values between men and women.

The ANOVA test indicates a statistically significant difference in mean response values between men and women ( $F(1, 288) = 8.102, p < 0.01$ ). In the project, men had a higher rating (4,307) than women (3,898).

Do men expect more that their roles and responsibilities will change significantly after the implementation of ESG reporting? The ANOVA test does not indicate a statistically significant difference in mean response values between men and women ( $F(1, 288) = 1.034, p = 0.311$ ).

Are men more likely to believe that ESG reporting will have a long-term positive impact on their careers? (2.51 vs. 2.64). The ANOVA test does not indicate a statistically significant difference in mean response values between men and women ( $F(1, 288) = 1.815, p = 0.180$ ).

Men are more likely to expect great opportunities for professional development related to ESG reporting. These differences are statistically very significant. The ANOVA test indicates a statistically significant difference in mean response values between men and women ( $F(1, 288) = 5.778, p < 0.05$ ).

Both groups expect new services in the future (4.06 and 3.96). The ANOVA test does not indicate a statistically significant difference in the mean response values between men and women ( $F(1, 288) = 0.096, p = 0.757$ ).

There are no significant differences in the expectation of obstacles to the development of new services (3.03 and 2.99).

**Table 1:** Answers to questions according to length of service/age of respondents

<b>Question</b>	<b>How many years of work experience do you have?</b>	<b>N</b>	<b>Mean</b>	<b>Std. Deviation</b>	<b>Std. Error</b>
1. I am fully familiar with the concept of ESG reporting?	less than five years	42	2,095	1,495	0,231
	between five and 10 years	33	1,939	1,321	0,230
	between 10 and 15 years	14	2,786	2,007	0,536
	between 15 and 20 years	45	1,778	1,106	0,165
	between 20 and 25 years	45	2,111	1,613	0,240
	between 25 and 30 years	22	2,136	1,726	0,368
	more than 30 years	89	3,090	1,676	0,178
	Total	290	2,372	1,614	0,095
2. Do I know the main standards and frameworks for ESG reporting (Global Reporting Initiative, Sustainability Accounting Standards Board, Task Force on Climate-Related Disclosures)?	less than five years	42	1,190	0,671	0,104
	between five and 10 years	33	1,091	0,384	0,067
	between 10 and 15 years	14	2,000	1,468	0,392
	between 15 and 20 years	45	1,333	0,640	0,095
	between 20 and 25 years	45	1,111	0,611	0,091
	between 25 and 30 years	22	1,091	0,294	0,063
	more than 30 years	89	1,079	0,271	0,029
	Total	290	1,186	0,604	0,035
3. I am fully ready to actively participate in the process of adopting ESG reporting.	less than five years	42	3,905	1,265	0,195
	between five and 10 years	33	3,970	1,159	0,202
	between 10 and 15 years	14	3,429	1,399	0,374
	between 15 and 20 years	45	4,044	1,167	0,174
	between 20 and 25 years	45	3,956	1,313	0,196
	between 25 and 30 years	22	4,000	1,512	0,322
	more than 30 years	89	3,978	1,373	0,146
	Total	290	3,948	1,298	0,076
4. Are my current skills and knowledge fully sufficient to work effectively with ESG reporting?	less than five years	42	3,952	1,168	0,180
	between five and 10 years	33	4,091	1,042	0,181
	between 10 and 15 years	14	3,714	1,267	0,339
	between 15 and 20 years	45	4,222	0,974	0,145
	between 20 and 25 years	45	4,000	1,243	0,185
	between 25 and 30 years	22	4,318	1,171	0,250
	more than 30 years	89	4,034	1,318	0,140
	Total	290	4,059	1,186	0,070
5. Do I expect my role and responsibilities to change significantly after the implementation of ESG reporting?	less than five years	42	4,095	1,122	0,173
	between five and 10 years	33	4,095	0,905	0,157
	between 10 and 15 years	14	4,095	0,646	0,173
	between 15 and 20 years	45	4,095	0,720	0,107
	between 20 and 25 years	45	4,095	0,725	0,108
	between 25 and 30 years	22	4,095	0,588	0,125
	more than 30 years	89	4,095	1,057	0,112
	Total	290	4,424	0,923	0,054

6. Do I think ESG reporting will have a long-term positive impact on my career?	less than five years	<b>42</b>	2,690	1,703	0,263
	between five and 10 years	<b>33</b>	2,242	1,582	0,275
	between 10 and 15 years	<b>14</b>	2,286	1,684	0,450
	between 15 and 20 years	<b>45</b>	2,267	1,587	0,237
	between 20 and 25 years	<b>45</b>	2,311	1,649	0,246
	between 25 and 30 years	<b>22</b>	2,545	1,920	0,409
	more than 30 years	<b>89</b>	2,933	1,776	0,188
	Total	<b>290</b>	2,559	1,707	0,100
7. I expect great opportunities for professional development related to ESG reporting.	less than five years	<b>42</b>	3,381	1,667	0,257
	between five and 10 years	<b>33</b>	3,455	1,716	0,299
	between 10 and 15 years	<b>14</b>	3,071	1,685	0,450
	between 15 and 20 years	<b>45</b>	3,556	1,700	0,253
	between 20 and 25 years	<b>45</b>	3,444	1,673	0,249
	between 25 and 30 years	<b>22</b>	3,455	1,819	0,388
	more than 30 years	<b>89</b>	2,933	1,608	0,170
	Total	<b>290</b>	3,279	1,672	0,098
8. I expect that accountants will offer new services and advisory activities to their clients in the future.	less than five years	<b>42</b>	3,929	0,745	0,115
	between five and 10 years	<b>33</b>	3,939	0,659	0,115
	between 10 and 15 years	<b>14</b>	4,571	0,646	0,173
	between 15 and 20 years	<b>45</b>	3,778	0,636	0,095
	between 20 and 25 years	<b>45</b>	3,911	0,701	0,105
	between 25 and 30 years	<b>22</b>	4,000	0,816	0,174
	more than 30 years	<b>89</b>	4,191	0,824	0,087
	Total	<b>290</b>	4,021	0,756	0,044
9. In the near future (within the next five years), I expect numerous obstacles in the field of the accounting profession	less than five years	<b>42</b>	2,905	1,008	0,155
	between five and 10 years	<b>33</b>	2,970	1,132	0,197
	between 10 and 15 years	<b>14</b>	2,714	0,994	0,266
	between 15 and 20 years	<b>45</b>	2,867	1,100	0,164
	between 20 and 25 years	<b>45</b>	2,556	0,867	0,129
	between 25 and 30 years	<b>22</b>	2,500	1,058	0,226
	more than 30 years	<b>89</b>	3,472	1,109	0,118
	Total	<b>290</b>	2,986	1,099	0,065

Source: Authors.

There are statistically significant differences in the answers to questions 1, 2, 6, 8 and 9 depending on the years of service.

**Table 3:** Answers to questions depending on the size of the company where the accountants work.

Question	Size of the company	N	Mean	Std. Deviation	Std. Error	Confidence interval (0.05)	95% Confidence Interval for Mean	
							Lower Bound	Upper Bound

1. I am fully familiar with the concept of ESG reporting?	<b>Micro</b>	<b>9</b>	1,889	1,269	0,423	0,83	0,62	3,16
	<b>Small</b>	<b>19</b>	2,526	1,867	0,428	0,84	0,66	4,39
	<b>Medium</b>	<b>118</b>	2,119	1,514	0,139	0,27	0,60	3,63
	<b>Big</b>	<b>139</b>	2,547	1,652	0,140	0,27	0,90	4,20
	<b>Total</b>	<b>285</b>	2,372	1,614	0,096	0,19	0,76	3,99
2. Do I know the main standards and frameworks for ESG reporting (Global Reporting Initiative, Sustainability Accounting Standards Board, Task Force on Climate-Related Disclosures)?	<b>Micro</b>	<b>9</b>	1,000	-	-	#NUM!	1,00	1,00
	<b>Small</b>	<b>19</b>	1,105	0,315	0,072	0,14	0,79	1,42
	<b>Medium</b>	<b>118</b>	1,220	0,730	0,067	0,13	0,49	1,95
	<b>Big</b>	<b>139</b>	1,187	0,546	0,046	0,09	0,64	1,73
	<b>Total</b>	<b>285</b>	1,186	0,604	0,036	0,07	0,58	1,79

3. I am fully ready to actively participate in the process of adopting ESG reporting.	<b>Micro</b>	<b>9</b>	3,556	1,333	0,444	0,87	2,22	4,89
	<b>Small</b>	<b>19</b>	3,579	1,502	0,345	0,68	2,08	5,08
	<b>Medium</b>	<b>118</b>	4,059	1,303	0,120	0,24	2,76	5,36
	<b>Big</b>	<b>139</b>	3,942	1,284	0,109	0,21	2,66	5,23
	<b>Total</b>	<b>285</b>	3,948	1,298	0,077	0,15	2,65	5,25
4. Are my current skills and knowledge fully sufficient to work effectively with ESG reporting?	<b>Micro</b>	<b>9</b>	4,000	1,000	0,333	0,65	3,00	5,00
	<b>Small</b>	<b>19</b>	3,789	1,398	0,321	0,63	2,39	5,19
	<b>Medium</b>	<b>118</b>	4,153	1,196	0,110	0,22	2,96	5,35
	<b>Big</b>	<b>139</b>	4,036	1,182	0,100	0,20	2,85	5,22
	<b>Total</b>	<b>285</b>	4,059	1,186	0,070	0,14	2,87	5,24
5. Do I expect my role and responsibilities to change significantly after the implementation of ESG reporting?	<b>Micro</b>	<b>9</b>	4,444	0,527	0,176	0,34	3,92	4,97
	<b>Small</b>	<b>19</b>	4,684	0,671	0,154	0,30	4,01	5,36
	<b>Medium</b>	<b>118</b>	4,407	1,023	0,094	0,18	3,38	5,43
	<b>Big</b>	<b>139</b>	4,417	0,900	0,076	0,15	3,52	5,32
	<b>Total</b>	<b>285</b>	4,424	0,923	0,055	0,11	3,50	5,35
6. Do I think ESG reporting will have a long-term positive impact on my career?	<b>Micro</b>	<b>9</b>	2,667	1,581	0,527	1,03	1,09	4,25
	<b>Small</b>	<b>19</b>	2,263	1,522	0,349	0,68	0,74	3,78
	<b>Medium</b>	<b>118</b>	2,508	1,796	0,165	0,32	0,71	4,30
	<b>Big</b>	<b>139</b>	2,612	1,696	0,144	0,28	0,92	4,31
	<b>Total</b>	<b>285</b>	2,559	1,707	0,101	0,20	0,85	4,27

7. I expect great opportunities for professional development related to ESG reporting.	<b>Micro</b>	<b>9</b>	3,222	1,716	0,572	1,12	1,51	4,94
	<b>Small</b>	<b>19</b>	3,474	1,645	0,377	0,74	1,83	5,12
	<b>Medium</b>	<b>118</b>	3,297	1,721	0,158	0,31	1,58	5,02
	<b>Big</b>	<b>139</b>	3,273	1,641	0,139	0,27	1,63	4,91
	<b>Total</b>	<b>285</b>	3,279	1,672	0,099	0,19	1,61	4,95
8. I expect that accountants will offer new services and advisory activities to their clients in the future.	<b>Micro</b>	<b>9</b>	4,111	0,601	0,200	0,39	3,51	4,71
	<b>Small</b>	<b>19</b>	4,105	0,809	0,186	0,36	3,30	4,91
	<b>Medium</b>	<b>118</b>	3,992	0,768	0,071	0,14	3,22	4,76
	<b>Big</b>	<b>139</b>	4,014	0,752	0,064	0,12	3,26	4,77
	<b>Total</b>	<b>285</b>	4,021	0,756	0,045	0,09	3,26	4,78
9. In the near future (within the next five years), I expect numerous obstacles in the field of the accounting profession	<b>Micro</b>	<b>9</b>	3,111	1,054	0,351	0,69	2,06	4,17
	<b>Small</b>	<b>19</b>	2,474	0,905	0,208	0,41	1,57	3,38
	<b>Medium</b>	<b>118</b>	2,847	1,075	0,099	0,19	1,77	3,92
	<b>Big</b>	<b>139</b>	3,129	1,128	0,096	0,19	2,00	4,26
	<b>Total</b>	<b>285</b>	2,986	1,099	0,065	0,13	1,89	4,08

**Source:** Authors.

The analysis revealed statistically significant differences in responses to questions 1, 3, and 9, depending on the size of the company the accountants work for.

The research results indicate that several factors influence accountants' perceptions of ESG reporting. Among these, the size of the company emerges as a critical factor. Accountants employed by large companies demonstrate a statistically significant advantage in familiarity with the concept of ESG reporting. Additionally, they express greater willingness to actively participate in the adoption process while exhibiting less certainty regarding the adequacy of their current skillset for effective ESG reporting implementation.

These findings can be attributed to the heightened exposure of large companies to ESG reporting requirements. They are more frequently targeted by investors, clients, and other stakeholders who demand transparency regarding the company's ESG performance. Consequently, accountants in large companies have more opportunities to gain familiarity with the concept and participate in its adoption.

Another influencing factor is the accountants' work experience. Those with fewer years of experience exhibit a statistically significant decrease in willingness to actively participate in the adoption of ESG reporting. This can be explained by their potentially lower level of experience working with ESG standards and frameworks. As a result, they may have less confidence in their ability to deliver high-quality ESG reporting.

## CONCLUSION

ESG reporting has the potential to reshape the accounting profession significantly. Accountants must acquire additional knowledge and skills related to environmental, social, and governance (ESG) factors. This includes understanding relevant regulations, standards, and guidelines about ESG, as well as the ability to gather and analyze data associated with an organization's ESG performance. Traditionally, financial reports focus primarily on financial data. With ESG reporting, accountants will integrate ESG factors into financial statements to provide a broader picture of an organization's business success. This may involve incorporating information on environmental costs, social initiatives, and corporate governance practices. Undoubtedly, ESG reporting may lead to modifications in reporting standards. Accountants will need to adapt to ensure their reports accurately reflect an organization's ESG performance.

As ESG reporting evolves, accounting has the opportunity to become a key organizational advisor on sustainability, social responsibility, and risk management. Accountants can contribute by assisting in setting and tracking organizational sustainability goals, offering strategic advice on improving ESG performance, and participating in decision-making based on ESG analysis. With the growing investor interest in an organization's ESG performance,

accounting can play a crucial role in verifying the information included in ESG reports. Accountants can provide independent opinions and ensure reports are accurate, reliable, and compliant with relevant standards.

A study in Bosnia and Herzegovina identified key findings regarding accountants' perceptions of ESG reporting. There is very limited knowledge about these topics. Accountants believe they lack sufficient knowledge regarding the concept. Conversely, a high level of readiness for adopting ESG reporting was revealed. Despite acknowledging a lack of necessary skills and knowledge, accountants expressed a willingness to participate in the adoption process. Opinions diverged regarding the impact of ESG reporting on role, career, and development. While accountants anticipate significant changes to their roles and responsibilities, there is ambiguity regarding the long-term positive impact on careers and professional development opportunities. Similar uncertainty surrounds the future of the profession. While accountants anticipate the introduction of new services and consulting activities for clients, their stance on potential obstacles remains unclear. The study also revealed statistically significant differences. Accountants working in large companies demonstrated a significantly higher level of familiarity with ESG reporting than those in small and medium-sized companies. Additionally, accountants with fewer years of experience displayed a statistically lower willingness to participate in the adoption process compared to their more experienced counterparts. Interestingly, accountants in large companies were statistically less confident in their current skillset for effective ESG reporting compared to those in smaller companies.

The research findings highlight the importance for accountants to be knowledgeable about ESG reporting and possess the necessary skills to deliver high-quality ESG reports. Accounting firms must provide support to their accountants in learning about ESG reporting and developing the required skills and knowledge. This study also offers valuable insights into accountants' perceptions of ESG reporting. However, further research is needed to gain a deeper understanding of how other factors influence these perceptions. For instance, future studies could explore the impact of specific ESG themes on accountants' views.

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**Strategic Management**  
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Subotica (Serbia), 17-18 May, 2024

### **Dragana Đorđević**

Универзитет у Новом Саду, Економски  
 факултет у Суботици  
 Суботица, Србија

dragana.djordjevic@ef.uns.ac.rs

## **USABILITY OF MANAGEMENT ACCOUNTING TECHNIQUES IN CRISIS CIRCUMSTANCES**

**Abstract:** Management accounting has a wide set of various techniques for the purpose of decision-making, planning, coordination, control and motivation through performance measurement, budgeting, responsibility centers, transfer pricing, costing and cost allocation. Over the past two decades, the need to explain the mechanisms of business decision-making by expanding the focus from the internal environment to factors of the external environment such as exchange rate fluctuations, inflation, slowing down of economic activity, volatility of the stock market and others has been clearly manifested.

The strategic aspect and non-financial information, as important aspects of decision-making in crisis conditions, influenced the development of new and improvement of existing management accounting techniques. In the post-corona era, the central focus of management accounting tools and techniques becomes sustainability and accelerated technology adoption, so management accounting practices must be adapted accordingly. The intention of the work is twofold. First, the work tries to point out the environmental factors and influences that are the impetus for necessary changes and adaptability of the management accounting technique in the crisis circumstances. Second, the aim of the paper is a critical review of the current literature on the issue of the use of management accounting techniques in conditions of crisis and unpredictability in various types of entities and industry sectors. Finally, the aim of the paper is to consider whether new and proactive management accounting techniques are applied in crisis conditions or whether the management's focus is on the short-term realization of income and profit.

**Keywords:** Management accounting, decision-making techniques, crisis, changes, SMA.

### **INTRODUCTION**

The constantly evolving business environment confronts companies with numerous challenges that require continuous adaptation and innovation in the way of doing business. Ubiquitous globalization, rapid technological evolution, changes in the regulatory framework, as well as recent events shaking the world economy, such as the Covid-19 pandemic and the wars currently being waged, are factors that have dramatically transformed the way organizations do business today. In this context, the role of management accounting is becoming increasingly important, as organizations seek more efficient ways to manage resources, monitor performance and make decisions due to increasingly complex business challenges. Given the unpredictability and speed of changes in today's business environment, traditional approaches to management accounting are often not sufficient for organizations to achieve sustainable success, which is why there is a constant need to develop new techniques, tools and approaches to management accounting that can adequately respond to modern business challenges. It is critical that organizations provide access to relevant information that enables accountants to see the bigger picture of the business and enables the identification of risks and opportunities.

With the emergence of new technologies such as artificial intelligence, data analytics, and process automation, management accounting gains new opportunities to improve efficiency, accuracy, and adaptability in business

management. Advanced analytical tools enable organizations to gain a deeper understanding of their market, identify trends and predict future needs, while business process automation eases routine business tasks and allows employees to focus on value-added activities. Advances in technology are not the only factor affecting the transformation of management accounting. Changes in the regulatory framework, such as requirements for more transparent and accountable sustainability reporting (ESG reporting), also place new demands on organizations and their accounting functions. Business leaders are aware that success in modern business requires continuous adaptation and innovation, and management accounting plays a key role in supporting this process. Therefore, the development of new management accounting techniques and tools is an essential part of the strategy of organizations that want to remain competitive and successful in today's business environment.

## **1. ENVIRONMENTAL FACTORS AND INFLUENCES AS AN IMPULSE FOR CHANGES IN MANAGEMENT ACCOUNTING TECHNIQUES**

In today's dynamic business environment, factors such as changes in the global economy, crises caused by recent pandemics and wars, technological innovations, legislative regulations and market competition are key impulses for the evolution of the technical aspects of management accounting (Rikhardsson & Yigitbasioğlu, 2018). Executives are increasingly recognizing technology, data and analytics as key drivers of business transformation, and many organizations are deploying business intelligence and analytics (BI&A) technologies to support reporting and decision-making processes. Even before the crisis events that hit the global economy in recent years, the finance function was already in the process of digital transformation. The pandemic and resulting conflicts have further accelerated the digitization process, highlighting the need for rapid development and adaptation of skills and knowledge in the field of data analysis, artificial intelligence, robotics and intelligent process automation. The recent McKinsey Global Executive Survey (2021) found that organizations accelerated technology adoption by three to four years following the Covid-19 pandemic. This change in dynamics encourages organizations to adopt new technologies more and more intensively, thus emphasizing the key role of management accountants in financial management and accounting. Their expertise becomes crucial for the proper management of business in the new digital environment, where analysis, control and compliance are of crucial importance (Heniro, 2022). At times when a certain industry is facing challenges and difficulties, the ability to run a business and management accounting techniques play a key role in its survival. While an industry crisis may seem like an inevitable circumstance, businesses that have sufficient internal strength and management knowledge and skills demonstrate the ability to adapt and find new ways to survive. Therefore, the individual leadership ability becomes crucial in ensuring the survival of the company, providing hope and perspective in challenging times (Pešević, 2013).

Another topic that is becoming increasingly important in the light of current global challenges is the topic of sustainability. A recent report (WSG, 2022) by the Accountancy Commission of Singapore, in partnership with Workforce Singapore and SkillsFuture Singapore, highlights the need for talent with diverse skills to contribute to the accountancy profession at a time of accelerated digital development and trends shaping the sector. The areas of ecology, society and governance represent one of the areas of growth in the short and medium term due to greater emphasis on non-financial reporting. The role of management accountants comes at times when organizations need to work out the strategies of their upcoming plans and budgets, such as, for example, in environmental sustainability, management accountants must help financial directors evaluate environmental policies (Heniro, 2022).

In an environment that is prone to sudden changes, classic management accounting techniques are no longer sufficient for organizations to manage their resources effectively and achieve a competitive advantage. Given the challenging and unpredictable business opportunities, increasing emphasis is placed on the development and application of new management accounting techniques - Strategic Management Accounting (SMA). The term SMA was established by Simmonds (1981), who defined it as "collection of information and analysis of management accounting data about the company and its competitors, for the purposes of developing and monitoring business strategy". These new techniques not only complement traditional methods, but provide organizations with the necessary tools for adaptation and innovation in facing complex business situations, such as economic crises, technological changes and social instability (Naeemi et. al, 2020). Tyles (2011) emphasized that the key difference between SMA and conventional management accounting is that the conventional management accounting system does not take a long-term, future-oriented view; nor does it have a marketing or competitive focus, as does SMA. In this context, research and development of new managerial accounting techniques become key factors for successful management of organizations in the 21st century. The effectiveness of management in the modern crisis economy mostly depends on the ability of the organization's accounting and analytical system to provide quality information about the current state and the need to improve internal business processes in conditions of uncertainty and risk (Bobryshev et. al, 2020). The topic of developing innovative techniques in management accounting is not new, it was also discussed by Zawawi & Hoque (2010) arguing that the new economic environment forces companies to adopt innovative techniques of management accounting (Management Accounting Innovation-MAI), which should be further investigated. Chenhall & Moers (2015) also argued that management control systems should incorporate innovations in management accounting, in order to cope with the uncertainty of the external environment and make management control more effective. In their work, Petera &

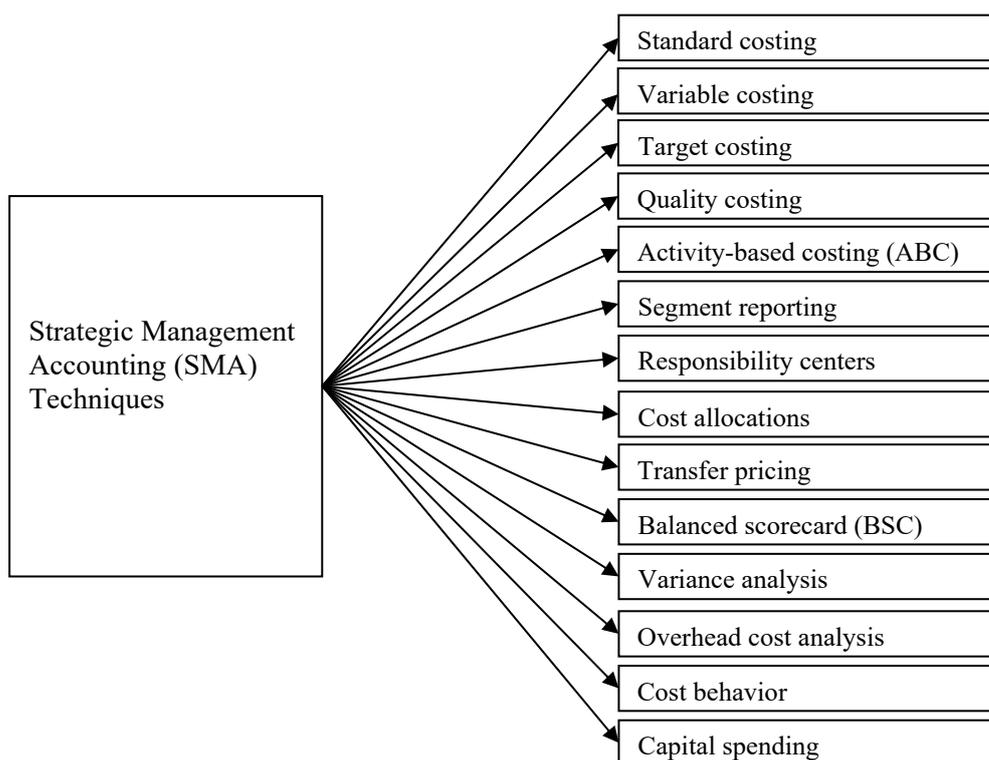
Šoljaková (2020) conducted research in which they proved that companies consider SMA techniques useful and want to implement them more in the future.

## 2. TOOLS AND TECHNIQUES OF MANAGEMENT ACCOUNTING - SMA TECHNIQUES

Strategic management accounting (SMA) encompasses a wide range of techniques that enable organizations to develop and implement strategies aimed at long-term success. These techniques include cost analysis, competitive analysis, strategic planning of costs and activities, as well as the use of key performance and success indicators to monitor and evaluate the achievement of strategic goals. SMA provides management with the tools and information needed to make decisions that support the organization's long-term sustainability and competitive advantage. Various organizations apply management accounting techniques to achieve management objectives. Some of the goals are (Rostami, 2015):

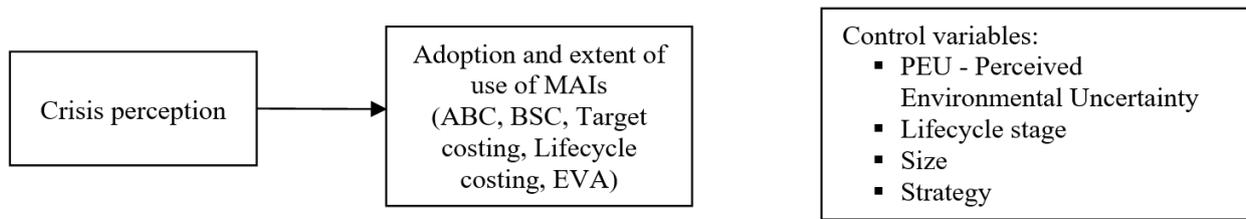
- Developing a long-term strategy and program
- Deciding on resource allocation
- Focusing on social responsibility
- Increasing the quality of services
- Helping managers in making decisions
- Motivating managers and employees
- Performance measurement and evaluation

In order to achieve the aforementioned goals, it is important to choose appropriate techniques with long-term goals and plans. According to previous studies, some of the SMA techniques are shown in figure number 1:



**Figure 1: SMA techniques**  
**Source:** Armitage et. al., 2016; Rostami, 2015

After considering management goals and identifying key management accounting techniques, Pavlatos & Kostakis (2018) directed further research towards developing a specific model. This model, composed of three key components - perception of crisis, adoption and use of innovations in management accounting (MAI) and control variables, provides a framework for understanding and analyzing the impact of crisis situations on the application of management accounting. Through a detailed investigation of these aspects, it is expected that a deeper insight into the decision-making processes and the effectiveness of the use of management accounting techniques in organizations facing crisis situations will be created. The model is defined as follows:



**Figure 2: Research model**  
**Source: Pavlatos & Kostakis 2018**

Data analysis conducted by Pavlatos and Kostakis (2015) showed that the extent of use of MAI is very high and that innovative tools are considered very important for the functioning of enterprises. The Balanced Scorecard (BSC) has a higher rate of adoption and use, compared to other innovative management accounting tools. Statistical analysis showed that business units usually adopt more than one MAI, which confirms the findings of Chenhall and Moers (2015), who believe that management control systems include innovative tools in management accounting, which results in providing more complex control of business activities. The analysis of the data also showed that those business units that were most affected by the crisis had a harder time adopting and using MAI, compared to those companies that were less affected by it. Crisis situations negatively affect companies' operations and increase business uncertainty, which limits the use of innovative management accounting techniques.

## CONCLUSION

In a dynamic business landscape where changes are happening constantly, management accounting plays a key role in adapting organizations to new challenges and taking advantage of emerging opportunities. Analyzing the environmental factors and influences that influence changes in management accounting techniques, it is clear that digitization, technological progress, regulatory requirements and social changes are the key drivers of innovation in this area. Organizations that recognize these factors and actively work to develop new management accounting techniques and tools have a significant advantage in creating a competitive advantage and achieving sustainable success. Taking into account all of the above, it is clear that management accounting not only follows changes in the business environment, but also actively contributes to shaping the future of organizations. Through continuous research, innovation and application of new techniques, management accounting becomes a key factor in developing business strategies, optimizing performance and achieving long-term growth. Through literature and research analysis, this paper explores in more depth the factors and influences shaping approaches to management accounting, identifying key impetuses for change in the field.

Looking at the current state and future directions of management accounting development, this paper provides a basis for further research and development in the field of management accounting techniques and tools. The identified gaps in existing studies point to the need for new research endeavors that would advance the understanding of this key discipline in business. The integration of the latest technologies and methodologies into the practice of management accounting represents an important step towards a more agile and efficient business, opening opportunities for the development of innovative approaches and tools. Further research on this topic can focus on identifying the most effective strategies for adapting organizations to new trends and changes in the environment, as well as studying the impact of those strategies on business performance and competitive advantage. Also, research can focus on the role of leadership and management in the process of implementing new management accounting techniques, as well as ways of developing an organizational culture that supports innovation and change.

There is room for research on how the integration of ESG factors (Environmental, Social, and Governance) affects management accounting and determining how organizations can use these factors to improve their performance and achieve sustainable growth. In addition, future research can focus on studying the interaction of management accounting with other functions within organizations, such as marketing and human resources functions, to better understand the overall impact of management accounting on business processes and decision making.

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# Session

4



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**Jelena Šidanski**Faculty of Economics, University of Novi Sad  
Novi Sad, Serbia

jelena.sidjanski@gmail.com

## **ARTIFICIAL INTELLIGENCE IN THE FUNCTION OF CONTENT CREATION IN DIGITAL MARKETING**

**Abstract:** The rapid advancement of techniques and technologies leads to the emergence of innovative solutions that facilitate, enhance, and shorten the time required for work. Companies are searching for innovative strategies that will help them more easily contend with growing competition and reach target desired consumers more precisely. Opportunities for business development increase through the use of artificial intelligence in digital marketing strategies. Considering that digital marketing requires the existence of marketing content, the success of a company's online communication largely depends on the quality of its content. Artificial intelligence transforms marketing by enabling companies to connect with the right audience in real-time through personalized product recommendations and dynamic content creation. The aim of this work is to present the benefits of artificial intelligence in the function of content creation in digital marketing. Secondary data, including the results of previous research, relevant industry reports, expert articles, and relevant statistical data, have been used in further research.

**Keywords:** Artificial Intelligence, Content, Digital Marketing, Personalization

### **1. INTRODUCTION**

In recent years, industries have undergone significant transformations driven by rapid technological advancements (Adwan, 2024). In the foreseeable future, Artificial Intelligence (AI) emerges as an essential component integral to global business operations (Alqurashi, Alkhaffaf, Daoud, Al-Gasawneh, & Alghizzawi, 2023). In various professional domains such as journalism, arts, music, and marketing, traditionally associated with human cognitive capabilities, artificial intelligence has progressively assumed more intricate roles. The domain of marketing, like others, has not remained unaffected by this trend, experiencing significant influence and transformation through the integration of AI technologies and methodologies. The marketing industry, in particular, has reached a critical juncture where adaptation to digital advancements has become imperative. Leveraging today's technology, businesses now have the capability to engage with their clients on a more personalized and intimate level, reshaping the dynamics of customer interaction and relationship management (Adwan, 2024).

Artificial Intelligence has experienced a significant transformation in the digital domain due to its rapid evolution and widespread adoption, fundamentally altering the dynamics of business operations and customer interactions. The integration of AI-powered tools and methodologies into contemporary marketing strategies has empowered marketers with innovative, streamlined, and impactful approaches to enhance customer experiences, refine data-driven decision-making processes, and foster growth in highly competitive markets. To optimize their marketing endeavors, identify essential consumer insights, and enhance outcomes without unnecessary complexity, marketers are actively pursuing solutions (Rathore, 2016).

Artificial Intelligence represents a technology that significantly contributes to enhancing the performance of digital marketing. AI's capacity to personalize content presented to customers is a result of its capability to process received

data and provide tailored recommendations. Consequently, digital marketing strategies have become indispensable for businesses to thrive in the online marketplace (Peña-García, Gil-Saura, Rodríguez-Orejuela, & Siqueira-Junior, 2020). A pivotal aspect of digital marketing involves the personalization of content, aiming to customize marketing messages and offerings for individual consumers. The increasing significance of content personalization in digital marketing is underscored by its potential implications for consumer purchase intention (Tran, & Nguyen, 2022). Empirical evidence from prior research strongly indicates that artificial intelligence plays a pivotal role in augmenting digital marketing strategies. AI technologies proficiently monitor consumer behavior in the digital landscape, furnishing marketers with valuable insights and facilitating the development of personalized customer databases. These databases encompass diverse information such as browsing history, purchase behavior, and preferences, serving as foundations for the creation of targeted marketing campaigns. The pervasive application of AI technology in numerous online shopping platforms is evident, offering consumers more precise and personalized services (Saadah, Suliyanto, & Rahab, 2023). This study examines the impact of Artificial Intelligence on content creation within digital marketing. It explores how AI tools streamline content generation processes, enabling personalized and targeted content tailored to individual consumer preferences. Additionally, the research investigates AI's implications for content optimization and ethical considerations in digital marketing practices. Through these inquiries, the study aims to elucidate AI's evolving role in shaping content creation strategies within the digital marketing landscape.

## **2. ARTIFICIAL INTELLIGENCE IN DIGITAL MARKETING: INFLUENCE ON CONTENT STRATEGY**

Artificial Intelligence (AI) is defined as both a scientific field and a collection of computational techniques. It draws inspiration from, but frequently deviates considerably from, the mechanisms by which humans employ their nervous systems and physical bodies for perception, learning, reasoning, and action (Pearson, 2019). AI encompasses a branch of computer science dedicated to crafting intelligent systems capable of executing tasks typically associated with human intelligence. These tasks range from learning and problem-solving to language comprehension and logical reasoning (Saadah et al., 2023).

In the contemporary business landscape, digital marketing leverages the Internet and interactive technologies to facilitate communication between businesses and their identified consumer base. It encompasses various strategies including search engine optimization, social media marketing, email marketing, content marketing, and online advertising. The primary objective of digital marketing is to interact with consumers in a more focused and customized manner than traditional marketing approaches. Its significance lies in its capacity to broaden audience reach, generate leads, and facilitate conversions in today's market environment (Saadah et al., 2023).

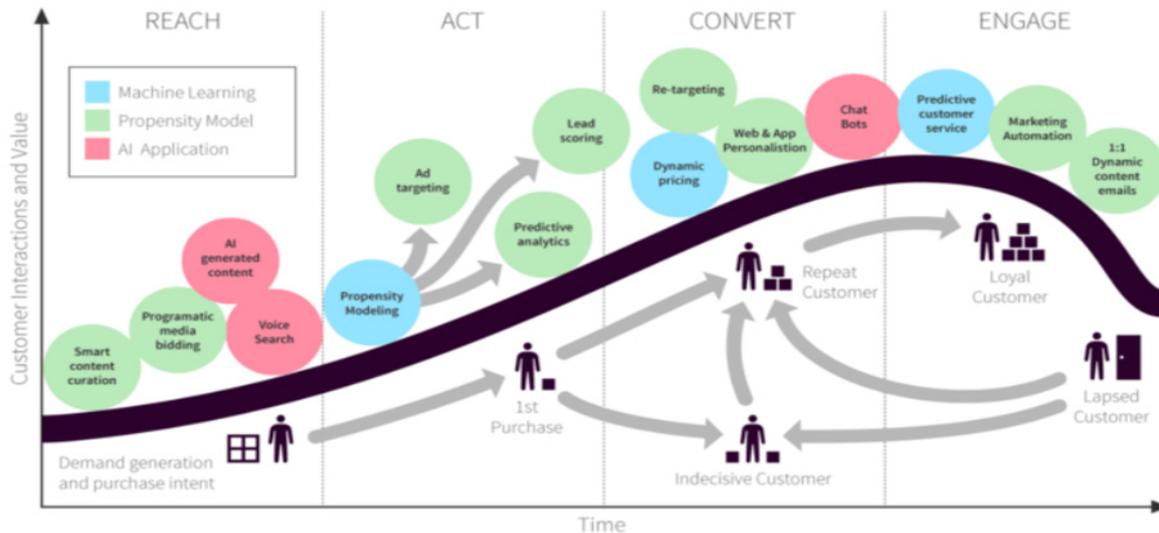
Content marketing is a strategic approach to marketing that revolves around identifying products tailored to meet customer needs, thereby fostering customer satisfaction and fulfillment. It entails the creation and dissemination of valuable, pertinent, and coherent content to captivate and maintain a distinct audience while encouraging profitable customer engagement. In essence, content marketing aims to capture customer interest and direct it towards the company's products or services. The crucial aspect of content marketing lies in its value. A piece of content qualifies for inclusion in a content marketing campaign if people actively seek it out and desire to consume it, rather than avoiding it. From a broader perspective, content marketing can take various forms, including news, videos, white papers, e-books, infographics, email newsletters, case studies, podcasts, how-to guides, Q&A articles, photos, blogs, and many other formats capable of capturing the interest of the target audience. The objectives of content marketing include enhancing brand awareness and reinforcement, fostering lead conversion and nurturing, facilitating customer conversion, providing effective customer service, encouraging customer upsell, and cultivating a base of passionate subscribers. These objectives are pursued through the design and implementation of content marketing strategies, leveraging the latest technological advancements. Information and communication play pivotal roles in utilizing diverse approaches to enhance and shape the current and future landscape of content marketing (Kose & Sert, 2017).

Artificial Intelligence plays a pivotal role in content development within digital marketing, offering significant advantages for businesses. However, many professionals in the digital marketing field require further expertise and training to fully leverage AI's potential in their strategies. The integration of AI technologies has brought about profound changes in the digital and social media advertising sectors (Nair & Gupta, 2021). AI has the capability to enhance content marketing efforts, enabling marketers to segment their audiences effectively and engage potential clients more efficiently. Through AI, tailored messages can be delivered to different subsets of the target audience. Studies have demonstrated AI's utility in digital marketing, aiding in customer data analysis, content optimization, and targeted demographic outreach (Haleem, Javaid, Asim Qadri, Pratap Singh, & Suman, 2022). AI can significantly assist businesses in digital marketing content creation, offering insights into consumer behavior through social media mining (Chintalapati & Pandey, 2021). In the realm of digital marketing, AI enables the delivery of more engaging content and provides insights into consumer actions and sentiments, facilitating informed decision-making and the development of more effective marketing campaigns (Huang & Rust, 2020). AI is poised to revolutionize digital marketing tactics (Haleem et al., 2022), shaping future marketing strategies and consumer behaviors (Davenport, Guha, Grewal, & Bressgott, 2020). Studies emphasize the benefits of AI adoption in content production for digital marketing, enabling a deeper understanding of the target audience, the creation of more engaging content, and the refinement of overall

customer outreach strategies. Recent academic and industry interest can be attributed to the proliferation of big data, increased accessibility to processing power, and advancements in AI strategies and technologies (Vlačić, Corbo, e Silva, & Dabić, 2021).

### 3. UTILIZING ARTIFICIAL INTELLIGENCE THROUGHOUT THE CUSTOMER JOURNEY

Consumers express their opinions through various channels such as blogs, tweets, "likes," videos, searches, comments, and conversations. Picture 1 illustrates customer interaction and value over time, highlighting the roles of machine learning, propensity modeling, and AI application at different stages. Successful customer experience serves as a competitive driver for growth, while unsuccessful experiences pose the greatest risk (Jain, & Aggarwal, 2020).



**Picture 1: Customer Journey**  
Source: Jain, & Aggarwal, 2020

Machine Learning involves analyzing historical data derived from diverse business interactions with audiences and their feedback. This data aids in identifying the key factors contributing to the success of communication strategies, encompassing targeting, offers, messaging, and frequency. Machine Learning algorithms generate insights through predictive analytics, and it's up to marketers to act upon these insights or establish specific directives for AI to follow. Propensity modeling involves estimating the likelihood of subjects engaging in specific behaviors, such as purchasing a product, by considering independent covariates and confounding variables. This likelihood is represented by a probability known as the propensity score (Jain, & Aggarwal, 2020).

The customer lifecycle consists of four major stages called "RACE", described as follows (Jain, & Aggarwal, 2020; Pearson, 2019):

1. **Reach**

Reach involves employing strategies like content marketing, SEO, and other 'earned media' techniques to bring visitors to your website and initiate them on the buyer's journey. AI and propensity models can attract more visitors and enhance the visitor experience. AI can ensure that programmatic ads avoid appearing on suspicious websites and/or remove them from the list of sites where the advertiser prefers not to be displayed. As advertising becomes increasingly automated, more ads can be generated with fewer personnel. AI should be integrated into this programmatic advertising process. Artificial intelligence technologies feature algorithms that analyze visitor behavior, enabling real-time campaign optimizations toward an audience more likely to convert. Marketers often find it challenging to identify when customers develop a need, as it typically occurs at the category level rather than the brand level. One key marketing strategy involves presenting potential offerings to meet customer needs and integrating the brand into customer's consideration sets. Marketers aim to increase brand visibility and establish critical reasons for consideration.

2. **Act**

Brands need to attract visitors and make them aware of their products and services. Machine learning algorithms can analyze extensive historical data to determine the most effective advertisements for individuals and various stages of the purchasing process. Leveraging such insights allows ads to be displayed to individuals with the most suitable content at optimal times. Employing machine learning to continually optimize numerous variables enables businesses to place their advertisements more effectively compared to traditional methods. Nevertheless, human input remains essential for creative aspects. Once customers express

their brand preferences, marketers strive to instill confidence in the offerings and convince customers that they are making the best choices. AI aids in achieving these objectives through predictive analysis, lead scoring, learning from consumer behavior, and providing real-time insights. Emotional AI can also be employed to gauge public sentiment about the brand.

### 3. Convert

After customers assess the value of their preferred brand and determine their willingness to spend, marketers transition from the decision-making process to the action phase. They strengthen the brand's value relative to its competitors, and AI can transform the consumer purchase process. Marketers implement intelligent purchasing systems and may adjust pricing dynamically to find the optimal pricing point. AI models can assist in suggesting the ideal combination of budgets across advertising portfolios. They can also predict the overall elasticity between advertising expenses and revenue, as well as propose the best budget distribution across portfolios. Additionally, AI can recommend the most efficient media blend, adjust advertising timing in real-time for optimal pricing, and evaluate bids hourly to enhance pacing during peak seasonal periods. By identifying the point of diminishing returns, AI ensures that budgets are allocated optimally.

### 4. Engage

During this stage, consumers evaluate their interest and satisfaction with a particular brand and decide whether to repurchase from that brand. Post-purchase services play a crucial role, and marketers leverage AI-enabled chatbots to enhance customer service. Marketers can identify their most valuable or loyal customers through segmentation and focus on customer relationship management campaigns accordingly.

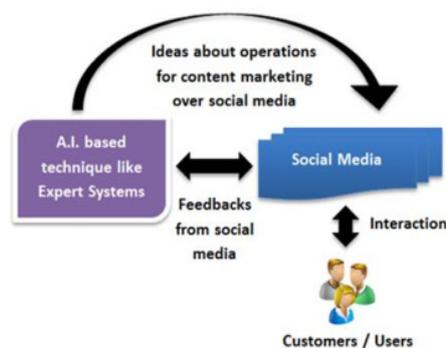
The strategic integration of AI, machine learning, and propensity modeling across the customer lifecycle, exemplified by the "RACE" framework, is instrumental in enhancing digital marketing strategies. This approach enables marketers to optimize interactions, drive conversions, and foster sustained engagement, providing a competitive advantage in the dynamic digital landscape.

## 4. ARTIFICIAL INTELLIGENCE IN CONTENT CREATION

In the realm of digital marketing, every business striving to attract potential customers and become their preferred choice must consistently deliver top-quality content and actively work on its development. Failing to prepare content development channels for the future today will leave businesses vulnerable to their competitors over time. It's impossible to resist the rapid advancements in technology, so it's crucial to keep pace with transformations to avoid falling behind. Marketing professionals play a vital role in integrating artificial intelligence into the enterprise's digital development, content creation, and strategy (YEĞİN, 2020).

Content marketing encompasses several stages, including preparation, implementation, and revision. The integration of artificial intelligence techniques such as estimation, optimization, expert support, adaptive guidance for customers/users, and error correction throughout the marketing process can significantly enhance each stage (YEĞİN, 2020).

A closer examination of the content marketing process unveils opportunities to diversify solutions through artificial intelligence. It is crucial to tailor content marketing processes with AI technology to cater to the specific needs and interests of consumers. Given the diversity in content marketing environments and approaches, there exists potential to design numerous combinations of intelligent content marketing processes (YEĞİN, 2020).

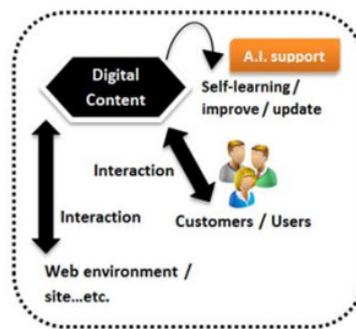


**Picture 2:** Model of “Intelligent Evaluation of Social Media”

**Source:** Kose, & Sert, 2017

Social media platforms offer a robust environment for companies and brands to effectively engage with customers. Leveraging this potential, businesses can enhance their marketing strategies by harnessing the power of social media to create impactful digital content. The integration of artificial intelligence can further optimize marketing initiatives on social platforms. Through AI-driven analysis of social media feedback, companies can refine their strategies and tailor operations accordingly. These evaluations may employ expert systems or sophisticated optimization algorithms to gain

insights into various aspects, such as brand pages and shared advertisements. Picture 2 illustrates a concise overview of this model (Kose, & Sert, 2017).



**Picture 3: Model of “Self-learning digital content”**  
**Source: Kose, & Sert, 2017**

Another aspect of intelligent learning management systems, as shown in Picture 3, involves the implementation of self-learning digital content mechanisms. These systems evolve and adapt by considering key factors related to user interactions. Thus, digital content systems can refine their content to be more engaging and relevant to suit various online conditions (Vadlamudi, & Hargrove, 2021). For instance, if digital content receives minimal feedback from users, it may undergo modifications to enhance its appeal. Conversely, content experiencing a surge in popularity might adapt to better suit diverse web environments (Kose, & Sert, 2017). Employing multiple AI techniques, such as a combination of artificial neural networks and machine learning methodologies, further enhances the sophistication of these frameworks (Paruchuri, 2021).

#### 4.1. AI tools

Generative AI tools represent a form of artificial intelligence capable of generating new content like text, images, audio, and even code by discerning patterns from their training data. The growing significance of these AI models is evident across diverse industries, offering the prospect of fostering collaboration and dynamic co-creation between human professionals and AI systems (Dang, Mecke, Lehmann, Goller, & Bushek, 2022).

Generative AI models stand out for their unique ability to autonomously produce fresh content, setting them apart from other AI models primarily focused on classifying or predicting based on existing data. Unlike their counterparts, generative models can create new data that closely resembles their training datasets. For example, research conducted by Gozalo-Brizuela & Garrido-Merchan (2023) showcases how models like ChatGPT or Stable Diffusion have been effectively used to perform tasks like answering questions or generating artistic images. These models exhibit the versatility to convert text into various formats including images, 3D images, videos, audio, code, and even scientific documents.

Artificial intelligence tools that generate automated content rely on Natural Language Generation (NLG) methodologies. NLG systems can transform data into precise, intelligent, and well-crafted automated content. While NLG shares similarities with natural language processing (NLP), it is distinct in its role of generating content rather than converting it. With the assistance of artificial intelligence, content creators can automate content generation for various tasks, ranging from simple to complex. Many prominent brands utilize AI-powered bots to produce automated content, enabling them to swiftly cover the latest news and updates while maintaining publishing consistency (Ahmed, & Ganapathy, 2021).

AI recommendation engines predict user preferences using algorithms like collaborative and content-based filtering. Collaborative filtering analyzes user relationships to suggest similar content, while content-based filtering matches content attributes to recommend relevant items. Hybrid systems combine both approaches for robust results, as seen in platforms like Netflix. These systems optimize accuracy by blending collaborative and content-based signals. They provide highly tailored suggestions by forming comprehensive user and content profiles. Continued advances in machine learning will enhance recommendation systems further (Ip, 2023).

The list below outlines the names, functions, and advantages of several beneficial AI tools, particularly highlighting their advantageous applications within a company setting (Valeur, & Liekis, 2023; Gozalo-Brizuela & Garrido-Merchan, 2023):

- ChatGPT is an AI chatbot employing natural language processing to generate conversational dialogue resembling human interaction, enhancing operational efficiency and conserving company resources.
- Stable Diffusion is a text-to-image generative AI model known for its ability to generate photo-realistic images from any given text input. It enables the creation of visually compelling images based on textual descriptions, offering a valuable tool for content creation and visual storytelling.
- Adobe Podcast AI is an artificial intelligence tool designed to analyze podcast audio, providing transcripts, captions, keywords, summaries, and other valuable insights, thereby aiding in content creation efforts.

- DALL·E is an AI tool used for creating digital images based on natural language descriptions, thus assisting in image creation processes and mitigating the risk of plagiarism.
- Jasper.ai is an AI tool designed to produce high-quality copy for emails, ads, websites, listings, blogs, and various other content formats, aiding in email, advertising, and content generation processes, among others.
- Surferseo is a tool that analyzes company pages against the top-ranking pages and offers SEO recommendations, assisting with SEO optimization efforts.
- Zapier AI facilitates the connection of AI by Zapier with thousands of popular apps, enabling automation of tasks and time-saving measures.
- make.com enables companies to visually design, construct, and automate workflows, aiding in task execution and workflow automation.
- Nifty facilitates the organization, planning, and prioritization of work, assisting in efficient work planning within the company.
- Motion.ai assists in managing schedules, recurring tasks, and meetings, aiding in effective time management.
- Grammarly offers grammar and spell checking, plagiarism detection, and writing suggestions for clarity, conciseness, vocabulary, style, and tone, enhancing the writing process.
- AutoGPT assists in evaluating its performance, refining past experiences, and leveraging its history to produce more accurate outcomes, thereby aiding in text generation and coding tasks.
- copy.ai facilitates the creation of texts, copywriting, or articles in a natural writing style, assisting with various aspects of content generation and more.

Generative AI tools revolutionize content creation by autonomously generating diverse media formats, fostering collaboration between humans and AI systems. Through natural language generation and recommendation engines, these tools streamline content creation processes and optimize operational efficiency across industries.

#### **4.2. Artificial Intelligence vs. Humans: Analysis in Content Creation**

The comparison between humans and artificial intelligence in content creation has recently garnered significant attention. AI has demonstrated its capability in producing outstanding artistic pieces, as well as proving its effectiveness in content marketing. Research has revealed that the quality, satisfaction, and readability of materials depend on the content source (human vs. AI) and the medium of information transmission (text, audio, video) (Correia, Liu, & Xu, 2020). Despite AI's potential in content production, Anantrasirichai and Bull (2021) found that AI-generated results surpassed those produced by humans. Thus, the advantages of AI in content creation vary depending on the type and context of the content being generated. Additionally, content produced by AI may be of slightly lower exceptional quality compared to human-generated content. Aizenberg and van den Hoven (2020) concluded that while AI systems can aid in generating significant evidence and efficient decisions, they can also provide people with illogical and biased decisions, potentially compromising human rights.

Conversely, although there have been calls for AI to be more ethical and socially conscious, advocates have offered few concrete solutions beyond emphasizing the need for openness, explanations, and fairness. The comparison between AI and humans in terms of imagination and moral weight raises significant questions. Gillespie's study emphasizes the importance of content control (Gillespie, 2020), and Ragot's findings suggest that people prefer artworks created by humans over those generated by AI (Ragot, Martin, & Cojean, 2020). Despite recent advancements, human resources remain limited, and activities requiring high levels of human involvement cannot be entirely mechanized (Cetinic & She, 2022).

Recent research indicates that celebrities using AI to enhance their market presence will attract a larger audience in the digital age. This is due to AI's ability to respond quickly to information and efficiently classify customers. Nevertheless, the inference drawn from this is that AI still requires further development before completely replacing humans in the workforce (Vrontis et al., 2021).

## **5. CONCLUSION**

The integration of artificial intelligence into content creation processes within digital marketing represents a pivotal juncture in the evolution of the industry. Technological advancements have continuously reshaped marketing endeavors, facilitating deeper integration of AI tools and technologies. For marketers, this evolving landscape offers unprecedented opportunities to engage with consumers in more seamless and instantaneous ways, fostering greater connectivity and interaction.

One of the most significant contributions of AI to digital marketing lies in its ability to enhance personalization and customer experiences. AI-driven algorithms analyze vast amounts of customer data to uncover insights, preferences, and behavioral patterns, enabling marketers to tailor content and offerings to individual needs. Through automation of repetitive tasks and optimization of content delivery, AI streamlines workflows and frees up valuable time for marketers to focus on strategic initiatives and creative endeavors. This paradigm shift enables marketers to deliver more relevant

and engaging personalized content to their target audiences, thereby enhancing customer satisfaction and driving higher levels of engagement.

The emergence of generative AI tools marks a transformative advancement in artificial intelligence, particularly in the realm of content creation. These tools leverage sophisticated algorithms and pattern recognition techniques to generate diverse content forms such as text, images, audio, and code. By analyzing patterns in training data, generative AI tools can create content that is both contextually relevant and engaging, opening up new avenues for creativity and innovation in digital marketing.

However, the integration of AI in content creation also presents challenges and considerations that must be carefully addressed. Data integrity, algorithmic biases, and ethical dilemmas are among the key concerns that marketers must navigate when utilizing AI-powered content creation tools. Ensuring transparency, ethical use of data, and ongoing evaluation are essential to uphold standards and foster trust with audiences.

Despite these challenges, the potential of AI in digital marketing is vast and far-reaching. As AI technologies continue to evolve, future research should focus on exploring the long-term implications of AI integration across various industries, examining the ethical considerations surrounding AI-driven content creation, and investigating its impact on job roles and workforce dynamics. Additionally, efforts should be made to evaluate the effectiveness of AI-generated content in engaging diverse audiences and to develop frameworks for assessing the quality and authenticity of AI-generated content.

In conclusion, the future of AI in content creation holds immense promise and potential for revolutionizing the way content is generated, curated, and delivered in digital marketing. As AI technologies advance and mature, marketers have the opportunity to leverage these tools to streamline workflows, enhance personalization, and drive greater engagement with audiences worldwide. By embracing AI-driven content creation strategies and addressing associated challenges, marketers can position themselves for success in an increasingly competitive and dynamic digital landscape.

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**Radenko Marić**Faculty of Economics in Subotica,  
University of Novi Sad  
Subotica, Serbia  
radenko.marić@ef.uns.ac.rs**Sonja Vučenović**Faculty of Economics in Subotica,  
University of Novi Sad  
Subotica, Serbia  
sonja.vucenovic@ef.uns.ac.rs**Goran Vukmirović**Faculty of Economics in Subotica,  
University of Novi Sad  
Subotica, Serbia  
goran.vukmirovic@ef.uns.ac.rs**Nikola Macura**Faculty of Economics in Subotica,  
University of Novi Sad  
Subotica, Serbia  
nikola.macura@ef.uns.ac.rs**Daniela Nuševa**Faculty of Economics in Subotica,  
University of Novi Sad  
Subotica, Serbia  
daniela.nuseva@ef.uns.ac.rs

## **THE FUNCTIONING OF RETAIL STORES OF FMCG IN CIRCUMSTANCES OF CRISES IN THE REPUBLIC OF SERBIA**

**Abstract:** The retail sector with its network of stores is an inseparable and one of the most important parts for the functioning of the economy and society in general in the modern dynamic market environment. This is particularly evident when it comes to the retail sale of fast moving consumer goods (FMCG). The fact is that the vast majority of the population does not produce food and other existential goods for daily consumption, but is completely dependent on the purchase of these products. Considering this, it is clear that any major turbulence caused by a certain crisis that directly or indirectly affects retail sector also affects consumers' life quality. Crises, such as those caused by the COVID 19 pandemic, lead to product shortages on the shelves, reduced opening hours of the stores, closure of stores in many locations, changes in the assortment of stores, increase in prices of products on retail shelves, longer waits for product delivery, less employees in the stores that are available to consumers, etc. If the global events that caused crises on market in the recent past have shown as anything, it is that crises will be more and more frequent, with an unpredictable length and even faster expectations for adjustments to market conditions in order to persist and remain competitive. The objective of this research is to look at the impact of these crises and their consequences on retailers and consumers, in order to predict new crises and make suggestions so that retailers can react to mitigate the effects of these crises.

**Keywords:** retail, consumer, retail store, FMCG, crises

## **INTRODUCTION**

Contemporary consumption and market conditions in which supply significantly exceeds demand in all categories of products could not be imagined without FMCG and a widespread network of retail stores that sell these products. Considering the fact that the natural production (products consumed by the people that made them) has been almost completely replaced by the commodity production (products for the market), the fact is that the majority of modern people do not produce food and other necessary products of daily consumption, it is clear that a developed network of such stores is essential for the functioning of urban areas in particular. Crises that are inevitable in modern business are present in some form at any moment. When one crisis ends, a new one emerges. In fact, crises have become so common that today they can be considered as normality rather than the exception. Each of these crises has an impact on the performance of numerous and complex activities within FMCG retail stores. These crises that have external influence on retail business, companies could only adapt to them and continuously rising of consumerism, which is also recognisable on the Serbian market, create retail microclimate on the market.

In the first chapter, the FMCG are defined in more detail, their categorization is carried out, the market potential of FMCG is explained and the forecast for the growth of this market in the future is given. In addition to this, the SWOT matrix of the entire FMCG industry with key strengths, weaknesses, opportunities and threats of doing business in this segment is explained. The trends shaping the FMCG market, the growth factors influencing this industry, the basic characteristics of FMCG important for their purchase, as well as the most typical FMCG sales channels are explained.

The second chapter deals with the impact of various crises on the FMCG market in the Republic of Serbia individually. The impact of two global and two domestic crises is explained. The influence of the COVID 19 crisis, the Russo-Ukrainian crisis and the crisis of shortages of milk and sugar, as the most representative FMCG on the market of the Republic of Serbia, is analysed. Each of these crises affected some or most of the activities of FMCG retail stores (displaying products, setting prices, generating demand, etc.). The paper explains the consequences caused by these crises, which affect the normal functioning of both retail stores and consumers in them. At the end of the analysis of each crisis, the explanation of measures taken to facilitate the activities within the retail stores and to mitigate the effects of such crises is given.

The aim of the work itself is to analyze the impact of these crises on traders and consumers, to predict the impact of new crises and, based on previous experiences, to give advice on what retailers can do to successfully overcome such crises. What gives this work additional importance is the fact that there are gaps in the contemporary retail literature in this area, which this work fills.

## **1. FEATURES, SPECIFICITIES AND TRENDS OF THE FMCG MARKET**

FMCG, also known as CPG, are mainly products with higher turnover ratios and lower prices compared to consumer durable goods. These are goods that are mostly completely consumed after the first consumption and often have to be bought again and again. FMCG include five categories of products such as packaged foods (prepared meals, canned foods, sweets and snacks), beverages (soft drinks, juices, water, alcoholic beverages), cosmetic products and household chemicals (shampoo, soap, toothpaste), non-prescription drugs (vitamins, analgesics, first aid kit) and other consumer products such as hygiene products, pet food, office products.

In 2021, the global market for FMCG reached a value of 11,490.9 billion dollars. Estimates are that this market would reach a value of \$18,939.4 by 2031 through a compound annual growth rate (CAGR) of 5.1% according to Allied Market Research, the main growth generator of this market is certainly the global population growth that has exceeded 8 billion people in 2024 (Deliverect, 2019).

If we look at the SWOT analysis of the entire industry, we could conclude that the main strengths and opportunities for the growth of the FMCG industry are the development of electronic commerce (which has minimized geographical barriers), globalization and innovation (companies are expanding their global capacities, expanding and deepening their assortments), support of economic authorities of countries, etc. The main weaknesses and threats to the industry include low barriers to entry into the industry (which could threaten existing companies in the FMCG market and create a state of perfect competition), dependence on agriculture and climate conditions (any changes in agricultural cycles or disasters such as droughts or floods automatically reduce production), price sensitivity and price elasticity of demand i.e. any major price changes in terms of price increases will reorient consumers to competitors and substitutes (Verhoef, Noordhoff, & Sloot, 2022).

The FMCG market is significantly influenced by the trends that shape modern consumer. The modern consumer is well informed, able to distinguish quality from what it is not, globally oriented and less loyal to brands. One such trend is the "consumer as producer" phenomenon. Today, some companies enable consumers to produce FMCG at home. A company like the Club de las Grandes Cervezas del Mundo sells its consumers the equipment to make their own beer at home. Categories such as confectionary have seen growth by educating consumers on how to make their own sweets, highlighting the joy of making sweets at home and sharing what they have made with their families. One of the latest novelties in this area is the option of a 3D printer capable of producing all categories of food, the initial price of such a printer is around 1000 euros, this will certainly be one of the widely accepted novelties of the FMCG sector in the future.

The main sales channels for FMCG are hypermarkets (the youngest and largest self-service format in Serbia) and supermarkets, convenience stores (such as stores near airports, gas stations, newsagents, etc.), discounter stores, specialized stores, and online retailers. When we look at the Serbian market of FMCG, the appearance of discounters (German „Lidl“ and Russian „Svetofor“) has influenced the growth of the concentration of modern trade to the detriment of small traditional formats in the form of neighborhood stores. In 2023, compared to 2022, a growth trend of medium format (from 40 to 300m<sup>2</sup>) was recorded in the percentage amount of 3%, while in the same period, a growth of 5% was recorded by hypermarkets and supermarkets (RetailZoom, 2024).

More significant trends regarding FMCG are reflected in the growing demand for natural, healthier and "wellness" products. In addition to more environmentally friendly products, practices of environmentally friendly packaging of such products, such as edible and returnable packaging, are increasingly dominating. Electronic commerce, which has traditionally not been focused on food FMCG, is growing more and more in this segment. Personalization and adaptation of FMCG to the individual needs of consumers is becoming more and more relevant, examples of which are vegan and vegetarian friendly food products, lactose-free milk, etc.

When it comes to the factors that affect the growth of the FMCG industry, they include the population growth, which is the most important factor for the growth of the consumption of most food and non-food FMCG, important factors are also urbanization, increasing disposable income, technological advances (the production of the food with reduced costs will be increasingly relevant with the increase of global population) and change in consumer preferences (Deliverect, 2019).

From the consumer point of view, FMCG are bought frequently, they require minimal effort when choosing and purchasing products, they are completely consumed after the first consumption (or a smaller number of consecutive consumptions), relatively low price compared to durable products. From the producer's point of view, the profit per product unit is relatively small, the volume of sales is critical for the profitability of business in the FMCG industry, in most cases intensive distribution is the type of distribution of the FMCG, the competition in the industry is relatively high, which puts pressure on the prices of these products (Marić, Vukmirović, Marić, Leković & Vučenović, 2024).

## **2. THE CRITICAL REVIEW OF CRISES' INFLUENCE ON THE FUNCTIONING OF FMCG RETAIL**

There is almost no activity within retail store that is not affected in some way by external crises if they exist. The most representative example is the COVID 19 crisis in 2020. As a result of the panic that occurred among consumers after the outbreak of the crisis, a phenomenon known as "manic shopping" occurred. Consumers, fearing a larger-scale crisis, were stockpiling certain categories of food products with a longer shelf life and certain categories of non-food products. "Manic" purchases of flour (in 25kg packages), oil, sugar, yeast, water, toilet paper, disinfectants, soap and other food and non-food hygiene products led to the disappearance of these products from the shelves of a large number of retail stores. In response to this kind of consumer behavior, retail stores have introduced quantitative restrictions on the sale of these products per consumer, the so-called "you can only purchase two pieces" policy. Such a policy was supposed to keep the shelves of the stores filled with the goods, on the one hand (which would prevent consumers from purchasing from the direct competitors who have deficient items on the shelves) and to prevent situations in which individual consumers would buy abnormally large stocks of some items which would lead to shortages of these items for other customers (Sharma & Sagar, 2023).

Of course, this policy does not imply necessary on a limit of purchases of up to two pieces. The retail chain "Sainsbury's" limited the purchase of certain items to two pieces, the "Tesco" chain moved this limit to 3, while the German supermarket chain "Aldi" set a limit of 4 pieces on certain products (Ministarstvo unutrašnje i spoljne trgovine, 2022). In Serbia, such restrictions were less significant and related less to food products than to disinfectants and other protective equipment (protective masks, etc.). Of course, the policy itself has its flaws, some consumers (dissatisfied with these restrictions imposed by some retailers) changed the place of purchase and purchased from those retailers where such restrictions do not exist. On the other hand, the question arises how to regulate situations in which the consumer buys a limited quantity of a given item, leaves the store and returns after a short time for additional quantities of the limited item (or simply sends someone else to do it). This was not a rare case during the COVID 19 crisis, especially in the developed countries. The prices of many goods that were the target of "manic" purchases would have skyrocketed if the government had not restricted the prices by regulation. So, even though sales increase for retailers in the short term under the influence of "manic" purchases, it should be considered that accumulated stocks of these products in the consumer households will delay future purchases of these products for a longer period of time. The situation with shortages of certain products caused a situation in which retailers formed waiting lists to sell certain products to consumers when the products become available again, so it was not a rare situation in which the new stocks of products in the store would be sold even before they arrive in the store (for instance yeast, flour, milk, etc.). This was common, first of all, for smaller neighborhood stores, which would make reservations for certain items to their everyday and most loyal customers (Kumar, 2024).

As a consequence of the change in the behavior of consumers and their purchases under the influence of the COVID 19 crisis, there was also a disruption in the procurement of these stores. Certain items such as flour, sugar, oil and yeast were either not easily procured by these stores or would be procured under worse conditions such as delays in deliveries, advance payments, higher prices, etc. Even if they managed to procure these items, retailers would procure them in much larger quantities than usual (in order to secure their stocks in the long term), which would further burden storage capacities and increase storage costs. Many retailers ran out of storage space, so it was not uncommon for them to close cafes, mini pizzerias and other facilities within supermarkets and hypermarkets in order to free up additional storage capacity. The products would also be temporarily stored in trucks due to the lack of adequate storage capacity (Ministarstvo unutrašnje i spoljne trgovine, 2022).

The COVID 19 crisis has imposed strict rules of behavior for employees and consumers in the stores. Many of these rules were prescribed by the government of the Republic of Serbia, application of these rules was monitored by competent state inspections. Prescribed physical distance of 2 meters between consumers, wearing of medical masks inside stores, restrictions of the number of people allowed in stores at the same time, installation of special equipment to prevent the spread of virus such as dezo-barriers (at the entrance into stores), special visors that had to be worn by retail employees, gloves when serving customers, etc., were just some of the measures taken to prevent the spread of this virus ("Sars-cov-2"). All these measures and additional mandatory prescribed equipment by the trade authorities of the

country imposed significant complications in the execution of daily activities in the stores. Employees often wore medical masks and gloves under their visors, which could be extremely tiring during eight-hour physical work in these stores, on the other hand, they had to monitor the behavior of consumers in the stores in terms of wearing medical masks, keeping the prescribed distance and the number of consumers who could be in the store at the same moment. This monitoring of the consumers was extremely important for FMCG retail companies, the measures had to be implemented otherwise in the case of detection of irregularities in the implementation of these measures (situation in which the consumer does not wear a mask in the store for instance), the authorities would punish the retail company. All of this put additional pressure on the employees in these stores and made it difficult for them to perform their daily work activities (Olutimehin, Nwankwo, Ofodile, & Ugochukwu, 2024).

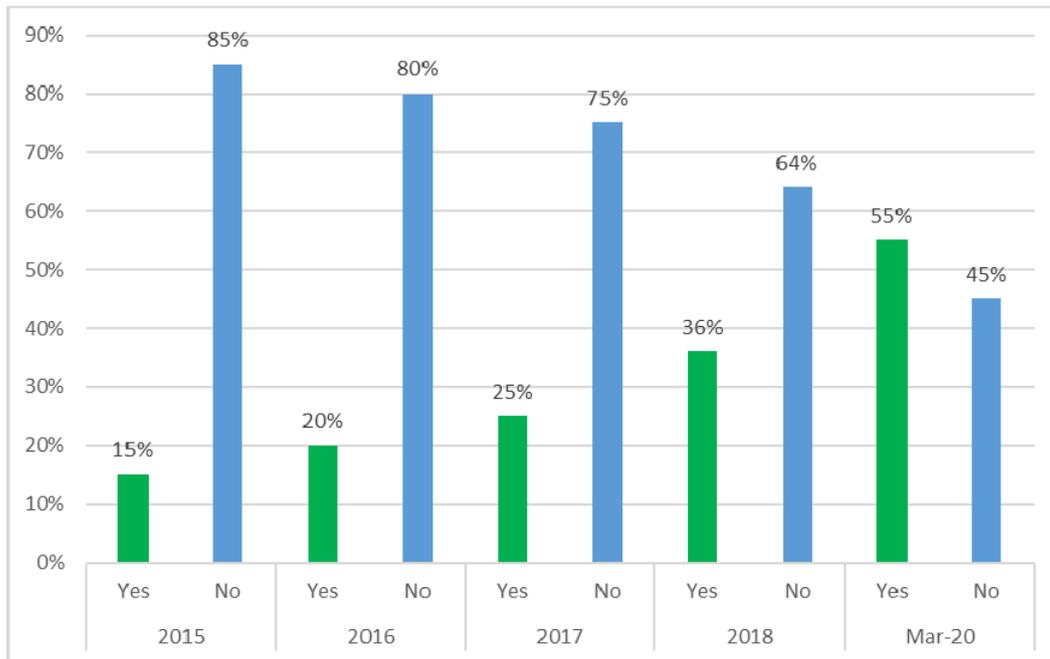
As one of the consequences of the COVID 19 crisis, there was a lack of employees in FMCG retail stores. The lack of labor in the retail sector in Serbia was present even before the COVID 19 crisis. In addition to retail sector, the sectors with a labor force deficit in Serbia include catering and construction. However, the COVID 19 crisis made this situation even more difficult. Employees in the retail stores, which are the most vulnerable due to the nature of their work, would go on sick leave in the form of two-week home isolation. The number of employees within the stores decreased significantly, which was reflected in the dynamics of customer service in the stores, but also in the dynamics of refilling the shelves with new stocks. Due to this problem, some retail companies would shorten the working hours of their stores or, in a worse case, would close them completely. In order to protect the rights of employees during sick leave, the government of the Republic of Serbia made a recommendation (for all companies) that sick leave should be paid in the form of 100% of the regular salary during the period of sick leave that is caused by „Sars-cov-2“ virus, which in regular circumstances would be 65% of the regular salary (Ministarstvo za rad, zapošljavanje, boračka i socijalna pitanja, 2020).

One of the measures adopted by the authorities of the Republic of Serbia, which significantly affected the working activities within the stores, is the limitation of the working hours of consumer goods stores. It should be taken into account the fact that these measures were primarily related to catering facilities such as restaurants, cafes, discotheques. As a result, these facilities had the most restrictive limited working hours (for instance complete suspension of work on weekends, weekdays working limit until 6 p.m., etc.). Retail stores selling FMCG had a bit milder restrictions on working hours, firstly working hours were limited to 10 pm, and later the government tightened the limit firstly to 9 pm and then to 8 pm. These limits mainly applied to the afternoon hours of work, and less to the morning hours (from 5 in the morning all facilities and stores could start working again). As a consequence of this, many activities that were carried out in later hours are now moved to earlier hours (requirements for new supplies had to be made earlier, counting of money at the end of the working day, etc.). Such a measure can potentially disrupt the sequence and time frame of performing basic work operations within the stores, which can cause problems. The consequence of such a measure may be a drop in the daily turnover of certain stores, because there would be a consumers who at a given moment would like to buy something but cannot.

Therefore, it is clear that the COVID 19 crisis affected consumer behavior in terms of the frequency of purchases and the volume of purchases. Consumers began to buy significantly less often compared to earlier periods before the crisis due to the potential possibility of contracting the virus, on the other hand, due to the lower frequency of purchases, consumers began to buy in significantly larger quantities compared to the period before the crisis. Many companies, especially at the global level, have started to introduce alternative channels and types of sales. This should not be surprising considering the results of an survey which showed that as many as 80% of respondents included in the survey reoriented themselves to buying FMCG online. As a result of these changes, the online purchase of FMCG increased from 3% before the pandemic to 12.5% after the pandemic. In this regard, a huge number of trading companies have started to introduce delivery as an integral element of the offer. In addition to classic physical delivery, the so-called "click and collect" strategy was applied. This strategy would include consumer orders online or for example by phone, immediately after the retailer of FMCG receives the order, he packs the products and separates it to a specially prepared place from where the consumer will pick it up physically (Delasay, Jain, & Kumar, 2022).

Both of these strategies take the consumer out of the retail store completely (as in the case of delivery) or almost completely (as in the case of the "click and collect" strategy). In the first "delivery" strategy, retailers often used the services of so-called "Third-party" companies to perform physical delivery. In another "click and collect" strategy, the consumer has to come physically to the retailer's store, but stays there minimally, practically just paying and picking up the package (Delasay, Jain, & Kumar, 2022). On the other hand, the strategy of delivering products to the consumer's home address is an option that requires less involvement of the consumer in terms of arrival, but is a significantly more expensive option compared to the "click and collect" strategy for the retailer (fuel costs, driver's wages, vehicle amortisation, etc.). These are the two most used omnichannel strategies during the COVID 19 crisis. What further increased the implementation of these omnichannel strategies is the fact that there were waiting queues in front of the stores. Restrictions in the form of the maximum number of consumers who can shop in a retail store at a same moment often resulted in the formation of endless queues in front of the entrance to the retail store (this was not characteristic only for retailers of FMCG). The fact that it is necessary to wait in front of the retail store outdoors, and often for a long period of time, has forced consumers to turn to more sustainable alternative omnichannel strategies, regardless of the fact that the use of some of these services would require the payment of a premium amount for the service by the consumer. One way to make these strategies cost-effective to the retailers is to set a minimum purchase amount that customer must make in order to be eligible for delivery or curbside pickup service.

When it comes to home delivery, which retailers began to significantly develop after the outbreak of the COVID 19 crisis, the effects that this crisis had on electronic commerce in the Republic of Serbia should be highlighted. According to data from the National Bank of Serbia, 2020 is the first year in which in the first half the value of transactions on the Internet via payment cards in dinar currency was higher than the value of transactions on the Internet via payment cards in all other currencies combined. On the other hand, in the same period (the first half of 2020), the number of transactions made on the Internet with payment cards in the dinar currency (about 14 million) significantly dominates in relation to the number of transactions made on the Internet with payment cards in all other currencies combined which is about 6 million (Narodna Banka Srbije, 2024). The very impact of the COVID 19 crisis on e-commerce in Serbia is visible in the increasing involvement of the "baby boom" generation in online shopping since 2020. (Tanasković, 2022).



**Chart 1:** The Answers of 1500 USA consumers asked if they bought FMCG online  
**Izvor:** (Soper, 2020).

On the Chart 1 we can see results of the research which is carried out by the global investment bank "RBC Capital Markets" conducted a survey of the attitudes of USA consumers regarding the purchase of FMCG for 5 consecutive years. In just five years from 2015 to 2020, the percentage of those who said they bought FMCG online increased from 15% in 2015 to 55% in 2020. It is clear from the graph that the percentage of those who bought FMCG online increased from year to year. However, this increase is most visible precisely in the survey conducted in March 2020 (1500 respondents) when the percentage of those who bought FMCG (55%) is higher than the percentage of those who did not (45%), this clearly indicates the impact of the COVID 19 crisis on the change in purchases of FMCG when it comes to the sales channel.

Almost all crises, especially those like the Russo-Ukrainian crisis, cause an increase in FMCG prices in retail stores. The official annual inflation rate in the Republic of Serbia in 2023 was 12.5%, at the beginning of that year it was 15.8%, while at the end of 2023 it was 7.6% (Republički zavod za statistiku, 2024). The impact of this and similar crises on FMCG prices is best evidenced by a survey (panel) conducted by "RetailZoom" that included more than 4,700 retail stores (panel participants). The periods from November 2022 to October 2023 and from November 2021 to October 2022 were observed. In these two periods, changes in sales (value and volume) of the most important categories of FMCG in the Republic of Serbia were observed. The extrapolation method was applied.

According to the panel, the entire FMCG market (in the Republic of Serbia) recorded a decrease in sales volume of 1.3% compared to these two periods, while the growth in value sales amounted to 10.8% (RetailZoom, 2024). Therefore, it is clear that such a case (decrease in the quantities sold with an increase in the nominal amount of sales) is possible only with higher rates of inflation (in this case caused by the aforementioned global crisis). Research carried out by the RetailZoom showed that when we look at specific categories of FMCG, tobacco products had the smallest drop in volume sales and it amounted only 0.3%, while the value growth of sales of this category was 5.8%. After tobacco products, the smallest drop in sales volume, which is 0.4%, was recorded for the category of non-alcoholic and alcoholic beverages, while the value sales of this category increased by 10% between the two periods. The category of fresh fruits and vegetables had a 4.7% drop in sales volume, while the value sales growth for this category was 17.4%. Products in the food category had a drop in volume sales of 8.2%, while the increase in value amounted to 14.6%. The pet food category recorded a drop in volume sales of 8.8%, while the growth in value sales for this category, taking into account the two observed periods, amounted to 17.4%. The reason for the smallest decline in tobacco products

compared to other categories of FMCG when it comes to sales volume lies in the fact that the demand for these products is price inelastic, therefore volume sales are less sensitive to nominal price growth.

Certain categories of FMCG recorded growth in both volume and value of sales. The most prominent example of this is electronic cigarettes, where the volume of sales increased by 52%, while the value sales of this category jumped by an enormous 212% (RetailZoom, 2024). This is not surprising considering that the electronic cigarette market in the Republic of Serbia is still in its infancy. In addition to the category of electronic cigarettes, growth in both fields (volume and value) was recorded for the categories of meat and meat products (volume 1.9% and value 17.3%), as well as category of baby food (volume 1.4% and value 12.8 %). If we look at the analysis at the level of sales formats, hypermarkets and supermarkets recorded an increase in sales volume by only 0.1%, while value sales increased by up to 15.5%. Larger and medium-sized stores grew in volume by 0.5%, while the value growth of sales amounted to 13%. Small shops (neighborhood) decreased in sales volume by 2.9%, while value sales of this format increased by 5.2%. Convenience stores grew by 2.3% in terms of quantity, and 4.5% in terms of value. If we look at the analysis at the level of individual regions of the Republic of Serbia, between the two periods, the Belgrade region had a decrease in volume sales of 1.2%, while value sales increased by 13.1%. The North region recorded an increase in volume sales of 1.5%, in terms of value, that increase was 13%. The East region had a decrease in sales volume of 1.3%, while it recorded an increase in value sales of 10.9%. The western region recorded a growth of 5.5% in the volume of sales, while the growth of value sales amounted to only 3% for the observed two periods (RetailZoom, 2024).

The increase in prices of certain categories of FMCG in Serbia during the current Russo-Ukrainian crisis was so frequent that many employees of various retailers of FMCG complained about the situation in which it is physically impossible to set all of the price tags regarding to price changes. All this leads to confusion for consumers who take products from the shelves at one price, only to pay a higher price at the checkout, which meanwhile went upwards.

One of the crises that hit the retail sector in the second half of 2022 was the so-called "milk crisis". The cause of this crisis was the unrealistically low purchasing price of raw milk charged by the producers, which in that period ranged from 40 to 50 dinars, while at the same time there was an increase in the prices of concentrates for feeding livestock. Also, one of the causes of this situation lies in the fact that the livestock fund in the Republic of Serbia has been significantly reduced in the past few years. The biggest blow to the supply of milk was recorded in September, in order to put milk back on the shelves, the Government of the Republic of Serbia canceled the regulation which was limiting the retail price of milk to 128.99 dinars per liter (in retail) and imposed export trade barriers for the export of domestic milk. During that period, retail stores in Serbia either completely ran out of milk or sold more expensive imported milk. Some of the most famous imported milk brands were the Polish "Uchate" which was sold for 166 dinars per liter and the Czech „Kunin“ which was sold for 133 dinars per liter. Many trade experts believe that this shortage was artificially caused, they believed that there were hidden stocks of milk, which were not marketed intentionally in order to increase the market price of the milk. Many believe that one of the reasons for the shortage of milk is that it was more profitable for producers to process milk into cheese and other dairy products because their prices are relatively higher, so such placement is significantly more profitable. In that period, milk stocks were one of the instruments of companies (of those who had them) to attract consumers to their stores (Ministarstvo unutrašnje i spoljne trgovine, 2022).

Another crisis affecting retail shelves in the Republic of Serbia, which occurred in May 2022, is the so-called "sugar crisis". The cause of this crisis lies in the low retail price of sugar per one kilogram package, which was prescribed by the government decree. The problem lay in the fact that the price was limited only for packages per kilogram, while for other packages such as 5, 10 and 15 kg packages there was no price limit by regulation. Sugar processors (such as those in the confectionary industry, brandy makers, etc.) have realized that it is more profitable for them to buy sugar in kilo packs in large quantities instead of paying the relatively higher price of 5, 10 and 15 kg packs that did not come under government regulation (the price of such packages expressed per kilogram was higher than the price of 1 kilogram packages). As a consequence of this, there were shortages of kilo sugar in most retail stores in the Republic of Serbia. The situation, although similar to the previously described situation of milk shortage, was solved in a different way. This time, the government did not decide to unfreeze the prices (which would increase the amount of sugar offered on the market), but decided to freeze the prices of sugar in packages of 5, 10 and 15 kilograms (so that the total price divided by the kilogram cannot be more than prices of sugar per kilo package). In this way, it was no longer more profitable for certain producers of the confectionery industry and other sugar processors to buy sugar in kilo packages, which certainly affected the return of one kilogram sugar packages to the shelves. On the other hand, the trade authorities placed on the market about 260 tons of sugar from state commodity reserves, which was supposed to satisfy the usually higher demand of the population for sugar in that period, many retailers also introduced a policy of limiting the purchase of sugar (in the packages of 1kg) per consumer by certain volume (Ministarstvo unutrašnje i spoljne trgovine, 2022).

A large number of cases like this are caused artificially by the participants of the distribution chain in order to increase the wholesale or retail price of the product which is or is not limited by the regulation. Very often, false information is published about shortages of certain essential products in the market, which causes panic among consumers who then purchase in large quantities. In this way, increased demand puts upward pressure on prices, which is good for the sellers of such products. In such situations, a retailer who has a sufficient quantities of a deficit item achieves a competitive advantage over the others. All the described crises that had an impact on retail, such as the COVID 19 crisis, the Russo-Ukrainian crisis, the crisis of milk and sugar shortages, affect the changed work and functioning of retail stores in terms of health protection measures (COVID 19 crisis), the increase in the prices of products on the shelves (Russo-Ukrainian crisis), product shortages (COVID 19 crisis, "sugar crisis" and "milk crisis"), etc. These crises occur completely

independently of individual retail stores, in that sense the stores can only adapt to them. One of the most important things in such moments is the education of consumers by retail stores, in this way the effects of „manic“ purchases that only aggravate the crisis will be mitigated and the preconditions necessary for alleviating the crisis will be provided.

## MENAGERIAL IMPLICATIONS

The fact that most retail companies cannot influence these crises does not diminish the practical importance of the work, especially in the field of management. Examples of crises, their causes, impacts and symptoms given in this work can potentially be useful to retail managers when identifying new crises based on the analyzed ones. By understanding the analyzed crises, the retail store managers create a basis for easier solution of the future crises and mitigating their consequences. So even though all analyzed crises have different causes (epidemic, war, speculation, etc.), the consequences of these crises are identical (product shortages and price increases). Considering this, retail managers, while recognizing emerging crises, can create a set of preventive measures to mitigate the consequences of these crises, which would be reflected in more efficient procurement of products and mitigation of the price pressure.

## CONCLUSION

The real viability and stability of a retail system and retail network is revealed only after the outbreak of turbulence and crises, this is the true test of the retail FMCG system. Each of the analyzed crises leads to a series of consequences for activities within retail stores and to a series of governmental and corporate measures aimed at eliminating them. Some of the government measures that have been implemented to mitigate the effects of the crises are freezing and unfreezing prices, placing additional stocks of products from commodity reserves, health restrictions in the form of the maximum number of consumers in retail stores and other health restrictions such as mandatory prescribed distances in retail stores and shortening the working hours of retail stores. Some of the company's measures are setting a limit on the number of pieces that a consumer can buy, creating a waiting lists for certain goods, introducing delivery, educating consumers, etc. In fact, the main goal of retail stores in these situations is to keep shelves full of goods and retain loyal customers in crisis conditions. Crises have become the normality in the modern business world. Retail and logistics activities within the retail stores are under their constant pressure (Nuševa, Marić, Vukmirović, & Macura, 2023). If we look at the timeline of the four analyzed crises, it is clear that they took place one after the other, practically without longer periods of stability, often even overlapping. Constant shortages, irrational behavior of consumers, supervision of state authorities, huge and frequent price jumps, lack of employees in retail stores, rising costs (during the Russo-Ukrainian crisis the prices of renting facilities in Serbia rose significantly) and many other consequences become normality of FMCG retail stores. Unfortunately, crises appear and disappear completely autonomously in relation to the retail system of a country, the only thing left for retail stores is to adapt to them, hoping that the crises are of a temporary nature. Practice has shown that the greatest burden of these and similar crises is borne by final consumers in most cases, and most often through the payment of higher product prices as a consequence of such crises.

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**Dr. Róbert Dobó PhD**  
 Budapest Business University,  
 Budapest, Hungary  
 dobo.robort@uni-bge.hu

## **MILITARY CONFLICTS AND COUNTRY IMAGE: THE COUNTRY IMAGE OF BELLIGERENTS IN LIGHT OF UKRAINE, A DEMOGRAPHIC, COMMUNICATION CHANNEL AND POLITICAL PREFERENCE BASED PERSPECTIVE.**

**Abstract:** Country image is an important aspect in international relations (tourism, products and services, trade etc.) thus a lot of emphasis is put on it from a marketing communication perspective, in order to influence the individuals in their view. According to the aims of the sender, the messages can have a positive or negative effect on how we perceive certain regions or entire countries and their leaders or specific policies. Nye (2004) describes this projection as “soft power” when exporting ideas towards a desired outcome, Herman & Chomsky (2008) stresses that premise of discourse is influenced by topic setting, thus interpretation of events can be changed, which are in line with the work and theories of Bernays, who among other stressed that expected form of behaviour should be impacted, with the assistance of psychological techniques and propaganda (public mass persuasions). Thus conditioning the public for certain narratives in accordance to individual or political objectives can be considered as wide spread. This involves fake news and creative new ways of distributing desired narratives through online and social media marketing, given its proliferation, accessibility and low entry barriers (from a communication perspective) makes it an ideal platform for information (message) dissemination. Presently in 2024 there are more localised and international conflicts, where belligerents aim to persuade the public (voters) of their own and of other countries in their favour, thus of their moral superiority over their adversaries. This can in turn create political support for certain desired policies. In the article, according to my modest means, I will explore these techniques and theories, and show through the conflict in Ukraine, how different groups in Hungary (according to demographic markers, marketing communication channel trust, and political party preference) have varying opinions of those countries that are in the focus, namely Ukraine, the Russian Federation, the United States of America and the European Union. During my research a primary questionnaire study has been performed and preliminary data analysis suggests a strong correlation of communication channel trust and political party preference which in turn polarises public opinion about these states, all in a trend like fashion. Thus, where the individual gathers information and news; and what kind of political affiliation the same person has, will have an effect on the country image, meaning that different narratives can be identified and their effects shown in practice.

**Keywords:** Russia-Ukraine, marketing communication, communication channel, political marketing

### **1. INTRODUCTION**

Media and communication has been in the centre of attention, especially with the creative and new ways that mass media is able to target the individual. This is done not only by targeting larger audiences, but the individual through careful STP (Segmentation, Targeting and Positioning) techniques. We presume that these are new techniques, but targeting the individual for an expected form of behaviour is a classical thought. The ancient romans were one of the first to involve wide spread propaganda in their communication, as some scholars consider and bring up the example of the “SPQR” symbol being used as only a mere marketing communication technique. The inscription SPQR "Senatus Populusque Romanus" on the flag and shields of the legionaries was itself only a marketing ploy on the part of the

reigning emperor, since at that time (after 31 BC) neither the senate nor the people significantly influenced political decisions (Baines and O' Shaughnessy, 2014). Using communication to influence doesn't only mean to encourage for a specific behaviour. Propaganda is a term of Latin origin - "propagare" - meaning: to spread an idea, popularize a view, a theory. A term related to political marketing, which is a collection of doctrines and principles – or views – that an organization or movement disseminates (communicates – publishes) in order to promote some desired behaviour (Casey, 1944). By communicating a desired outcome, also involves deterring from certain actions that the public might take. The individual in society, the actions and thinking can be changed considerably when external factors, such as a crowd is involved. The individual will act against normal instincts, and this can be used if the psychology of the crowd is analysed (Le Bon, 1896). These techniques are still adopted today, as we are faced with organisations of multicultural character (Bendersky, 2007).

Today, not only groups are targeted, but there is a practice of influencing on social media which is called “micro-targeting”. Given the IT systemisation of consumers, information is gathered through online activities (smartphone, smart TV, or the platform provider) will store consumption patterns in the form of accessible data. This in turn can be converted from social interactions into real-time data that can be measured online, and not only describe social behaviour and its context, but can also be used to predict it. Thus IT analysis and evaluation enables micro-target groups to be defined and to be targeted individually (Andok, 2022. Chapter 6.).

This does not mean that classical or traditional offline media would be less important when distributing information. Having a one way interaction with the audiences, the sender has much more control over the message. Research has indicated that online advertisement may cause “vegging” effect on the user, meaning that they will be more passive towards ads and simply disregard them (Bezjian-Averiy, Calder and Iacobucci, 1998). Thus online messages may not be more effective than offline ones. Further complicating the issue is the data that indicates that increased interactivity may defer the user (the target) from the message itself, and makes the person engage in other things, thus interrupts the process of persuasion. As for the purposes of this study, this might not be a problem, as interactions form groups is an important aspect when gathering information and news. Users may identify similarly minded groups or individual when two-way communication is present, they are able to bond with one another and form new groups. These groups can be called “bubbles”. Social media interactions have shown remarkable possibilities, empowering individuals to form groups, thus gather and act together towards a collective, group interest (Harlow, 2013). Although other studies indicate that this “empowerment” effect might be limited.

We presume that all individuals are presented with all information that is available, thus they disseminate credible and fake-news, and we also presume that they gather information from a wide spread. Research indicates that this, may it be classical offline or new online media channels is not the case. The user has a “diet” of communication channels, meaning some that they frequent, and some that they disregard because of subjective personal reasons, thus the individual has preferences. When looking at social media (Eady et. al, 2019) data shows that clear trends are visible in both sides of the political spectrum, liberal and conservative. By looking at quintile data, in the two most liberal groups, 84-85% of respondents are in a media bubble, gathering information (following) more liberal channels, while the same trend only a bit weaker is present on the conservative side, 78% of people in the most conservative quintile exhibit similar patterns towards conservative media outlets and channels. In Hungary, similar patterns are visible according to the pro-government and pro-opposition line, voters preferring different mediums and communication channels (Hann et. al. 2020). This indicates that no matter if the message is seen on- or off-line, if it is not within the specific bubble that the user is a member of, the consumer will not take it as credible source and will probably disregard it.

It should be stressed that people live in “bubbles” that are formed and influenced by their political views. They gather information accordingly from different news sources and channels, thus they may be contrasted with different narratives. These same in turn can mean that two individuals may have contrasting views by the same events or in this case countries.

The aim of the study is to analyse the effects of narrative, and to show its functioning in practice with the help of a primary questionnaire study. Will political affiliation and information gathering preferences (channel based trust) change the image of the European Union, the Russian Federation, Ukraine, and the United States of America?

## **2. RESEARCH METHODOLOGY**

A primary study was conducted in the turn of 2023-2024 (December and January), that gathered the answers of 294 respondents, which were later digitally analysed on one hand using Microsoft Excel 2013, and also using IBM SPSS version 24. Descriptive statistical, Pearson's correlation analysis (using the ward method) on the available data was performed. During the data gathering, a snowball method was used through social media platforms, thus the data is not representative, but indicative. From the 294 respondents, some of the answers contained a high level of missing values that needed to be excluded, thus the analysis was performed on the remaining 280. It should be noted, that because of the nature of the research, I did not have the opportunity to collect longitudinal data, thus a snapshot is presented of the sample with a cross-sectional analysis of the obtained results.

During the in-depth analysis (IBM, 2021; Sajtos-Mitev, 2007), respondents marked on a 6 level Likert scale their level of trust towards communication channels, countries and political parties. The Pearson Correlation analysis measures the movement of two variables and indicates the direction, strength and significance of the linkage. It measure between +1

meaning total linearity and co-movement, and -1 meaning a complete inverted relationship. The closer values are to 1, the stronger the relationship. The program indicates significance, one star (\*) on a 0,05, while two stars (\*\*) on a 0,01 level. Positive correlation means that if the respondent gave a high number or value at one question, than the same higher level is visible at another one. No correlation means that the two data rows have no connection with each other, while a negative correlation shows an inverse relationship, if the participant gave a high value in one case, there is a low value at another question.

### **3. AGENDA SETTING AND NARRATIVE**

Although more cognitive biases can be identified, to understand the agenda setting theory, the framing effect (bias) should be considered. People tend to base their decisions more on how an issue is presented or "framed" than on the information that is put forward and communicated. Selecting the alternative that is more positively presented, or framed, is a cognitive default (Kahneman and Tversky 1979).

When comparing various media impact models and how recipients process news items that set agendas and frameworks is a complex issue. The level of focus on news messages necessary for the impacts to happen can be one point of comparison. We may presume that when viewers give news messages a lot of attention, a framing effect takes place. That is, an audience member who pays attention to a news article is likely to be most aware of the substance and consequences of an issue frame. One may apply a similar reasoning to the process of creating the agenda. It would seem that agenda-setting and framing work via comparable phenomenological mechanisms. On the other hand, the fundamental framing strategy postulates that the issue's description or the term applied to it in news reports have an effect. The main impact of a frame is the underlying interpretive schemas that have been applied to the problem. Thus, the key psychological distinction between priming and agenda setting on the one hand, and framing on the other, is the distinction between whether and how we think about a problem (Scheufele and Tewksbury, 2007). In simpler terms framing is picturing an issue in a positive or negative light, while agenda setting is the effect that media has on the public when transferring the news, while influencing in a deliberate way, how the public perceives the information. As shown in the work of Heideker and Steul-Fischer (2017) they find a strong correlation between credibility and the effect of source-based trust when examining the credibility of advertisements.

When examined how the media and public agendas are determined by the network, some research findings show strong correlations. According to this theoretical paradigm, news media outlets have the ability to simultaneously highlight various groups of objects or traits in the public consciousness (Guo, Vu and McCombs, 2012), thus link information from possibly unrelated events into one comprehensive agenda. This agenda setting nature of mass media has been demonstrated by McCombs and Shaw (1972) who indicate that mass media is able to make voters respond to the same events in different ways. Thus they have "alternative" approaches to news and daily happenings in the political sphere.

Nye (2004) describe different models of power, and one of them is "soft power" that is derived from cultural influence, rather than direct military confrontation when projecting power from one to another country. Thus in the line with the conflict in Ukraine, and country image, these soft power techniques should be analysed, one being the agenda and the narrative that people are confronted with, thus which in turn shapes the same public opinion. Thus mass media and communication channel usage is a soft power technique.

The fact that social media is currently the largest mass medium in Hungary, surpassing television (meaning the number of social media registrations – 7,4 million – is higher than the number of television subscriptions – 3,4 million subscriptions), means different approaches should be taken considering these mediums (Statista, 2024, KSH, 2024). At the same time, the ownership structure and profit goals of mass media should be considered when projecting news with an agenda. Previously, in the 60-70s there was public debate about the dangers of centralisation of media and news, in addition to foreign influence, especially in case of political coverage (Herman and Chomsky, 2008). Given the interconnected nature of media and the government interests, communication channels are the first filters when searching for news.

This interconnected nature and the specific functioning of social media has shown its drawbacks on multiple occasions. When looking at the elections of 2016 in the United States of America, research shows that an alarming rate of fake news were present through these mediums (Allcott and Gentzkow, 2016). This is partially happening because the costs affiliated with using this channel are negligible, especially for larger organisations (parties and affiliates). Thus in a conflict, the opponents may use these

### **4. FRAMING COUNTRY IMAGE**

Bernays (1942) describes the aim of belligerents as functioning in two ways. First, to secure the support of the domestic population, and second to demoralize the public of the "enemy". This also means that any unfavourable news should be communicated as lies from adversaries. From the list of models, for this research "propaganda of hope" should be further elaborated on, as one that aims in securing foreign support. This should be contrasted with the notion that propaganda should be used in a constructive way, to inform the population, to assist social change and evolution, namely to be involved in "peace propaganda" (Bernays, 1936). Thus the country image, the view that the public has

about the adversaries can be influenced by propaganda and targeted (framed) narrative, according to the aims of the sender.

Political communication is part of the political system, which is connected on the one hand to the communication system (channel politics, advertising) and on the other hand to the citizens/voters themselves. In this complex space, not only the exchange of messages takes place, but also the confrontation between different actors (Mazzoleni, 2002). In this interpretation, a three-player model emerges during communication, not two, since the media and all of its actors are parts of this system while creating and framing the narrative that they present to their receiving audiences. Therefore, the same phenomenon or event can have different meanings according to the goals of not only the political actor, but the media as well.

During image building, an actor is creating value for the organization and providing a complex experience that is created through experience (Papp-Váry, 2020). How can states or governments or political parties influence their image? If we want to go around the political image and branding, we will find several interpretations of the brand concept. Modern politics is the battle of competing images (Scammell, 2015). The image can be understood as a kind of manipulation that enables easier influence by creating a virtual image, as opposed to, for example, meaningful communication that requires higher cognitive abilities.

Another important issue when building the image is that in today's modern age, permanent campaigns are becoming more and more typical, even outside the traditional campaign period. This involves interaction between political organisations and the public (domestic and foreign). The interaction also helps the organization to collect data, analyse it, and then send even more effective messages, thus increasing the "customer", in this case public value (Kandikó, 2005), which in this form means the subjective satisfaction of the voter. Thanks to digitization, today's modern brands are no longer developed only through the traditional communication of organizations, but also during interactions in the online space, especially on social media platforms, as users have become integral parts and co-creators of the branding process (Dennhardt, 2012). ). This also confirms the importance of the previously discussed interactions between political actors and (potential) sympathizers (domestic and "enemy" public).

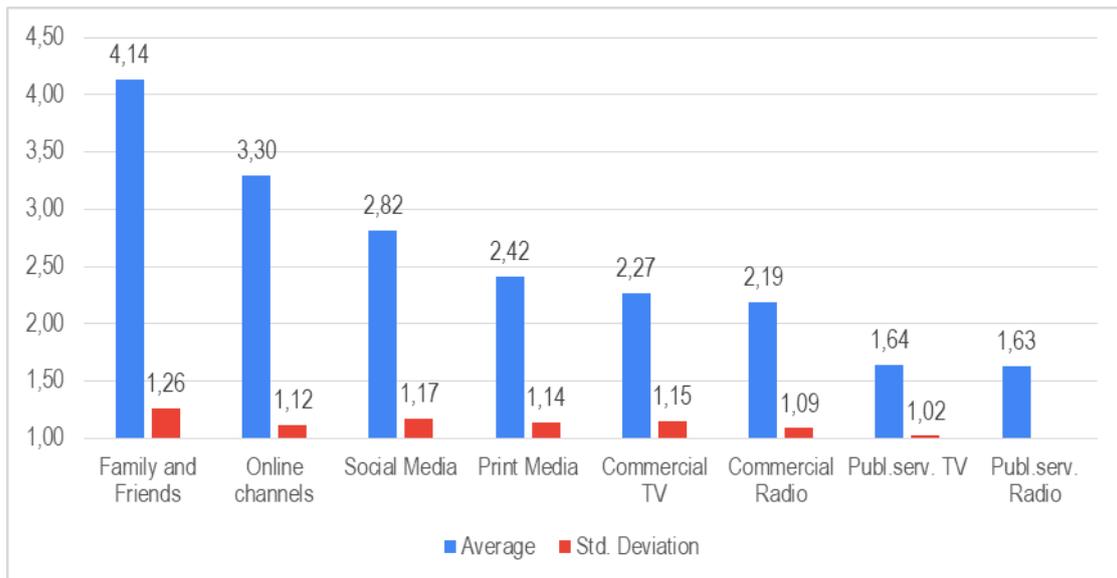
In this sense, two competing theories are present. One states that the individual is tied to the given party on a psychological and emotional basis (ideologically motivated), so they have a party identity (Downer, 2016). This can also be interpreted as psychological identification. Thus when contrasted with a country image, this identity will define the narrative and view. While the other, according to the interpretation of Ries and Trout (2001, Chapter I), the position is already in the mind of the public, so the basic approach to positioning (image) should not be to create something new, but to manipulate/modify the existing one. Thus when influencing the country image, should we target identity and individual motivations, or should the sender try to adapt and modify an existing image? The current scope of the article follows the logic of the first one, thus it is considered that affiliation and identity will have an effect on the country image.

As online platforms, as previously discussed especially social media have low entry barriers, beside traditional offline channels, country image can be affected by targeted ads and framed narratives by both parties in a conflict. Evidence suggests, that this spread of information (and dis-information, fake news, propaganda) is online is a growing international security concern (Bradshaw, 2020). These actions are visible in foreign information interference, spreading fake news and manipulating narrative (Rogers and Niederer, 2020).

## 6. PRIMARY STUDY ANALYSIS

During the research eight communication channels and eight political parties were analysed beside the main demographic factors (age, gender, city population, income level) on country image.

Considering the communication channels, Friends and Family were valued as the most reliable ones, followed by online channels and social media. Generally in all other cases except for Family and Friends channels trust is unfavourable and low, thus respondents consider them unreliable (the median is 3,5 in the 1-6 Likert scale), public service television and radio being the lowest. Standard deviation is showing a trend, the lower the average trust level, the lower the std. dev. thus respondents agree on more on those which they view unfavourably (See Picture 1.).



**Picture 1: Communication Channel Trust**  
**Source:** Own editing according the primary study

When performing a Pearson correlation analysis, the data shows a trend like picture. Those who trust information from Family and Friends view the Russian Federation in more positive light. Public service television and radio trust has a positive effect on the Russian Federation, while it has a negative effect on the image of the European Union and Ukraine. Online sources have opposing trends, those favouring these channels have a better opinion about the European Union, the United States of America and Ukraine. (See Table 1.)

Pearson Correlation	EU	USA	RUS	UKR
Family and Friends	-0,069	0,079	,266**	0,140
Commercial TV	0,031	0,139	0,131	0,057
Public Service TV	-,221*	0,016	,433**	-,151*
Commercial Radio	-0,003	0,142	,147*	0,030
Public Service Radio	-,258*	-0,043	,402**	-,258*
Online sources	,240**	,179*	-0,015	,174*
Social Media	0,040	0,124	,163*	,147*
Print Media	-0,092	0,020	0,134	0,020

**Source:** Own editing  
According to the primary study

In this case further analysis was performed to introduce a new correlation, if the political party preference and the communication channel trust has a relationship. Given the secondary data of Hann (et. al. (2020) pro-government respondents should trust public service channels and commercial television channels more, while opposition favouring ones online and social media.

The data shows that there is a correlation between which party someone prefers and where do they think credible information comes from.

The eight political parties analysed were: Fidesz (FID), currently in a coalition

government serving their fourth term. Democratic Coalition (DK), Hungarian Socialist Party (MSzP), Momentum (MOM), Jobbik – Conservatives (JOBK), Hungarian Two-Tailed Dog Party (MKKP), Hungary's Green Party (LMP), Our Homeland Movement (MIH). The analysis shows that those ideologically (IDE) agreeing with a party, also have more positive views when looking at communication channel trust. The ruling party and the conservatives trust information that come from Family and Friends, Public Service news sources and classical offline channels, while those sympathising with opposition parties trust online channels and social media. In two cases we see negative correlation, which mean that consentients of the Momentum and the Two-Tailed Dog Party generally distrust public service channels, associated with governmental news. Thus there is a clear preferential difference between governmental and opposition voters when it comes to communication channel trust, meaning that opposing political spectrums use different sources of information. (See Table 2.)

**Table 2:** Pearson Correlation values of the researched parties and the communication channels

	Fam.&Fri.	Com.TV	Pub.S.TV	Com.Radio	Pub.S.Radio	Online	Soc.Med.	Print Media
IDEFID	,184*	,196**	,408**	,172*	,411**	-0,035	0,049	,170*
IDEDK	-0,018	,163*	-0,040	0,110	-0,048	,225**	0,103	0,062
IDEMSZP	0,058	,249**	0,067	,169*	-0,013	0,129	,211**	0,058
IDEMOM	-0,030	,156*	-,151*	0,094	-,190*	,169*	0,117	0,095
IDEJOB	-0,042	0,097	0,136	0,068	0,088	0,055	0,107	,152*
IDEMKKP	-0,104	-0,100	-,174*	-0,043	-,195*	0,083	0,126	0,038
IDELMP	-0,018	,150*	-0,113	0,068	-,154*	,197**	0,089	0,082
IDEMIH	0,090	,172*	,377**	,207**	,369**	0,031	0,139	,172*

Source: Own editing  
According to the primary study

Because of the strong correlation of communication channels and political parties, when considering the political affiliation of the person and the researched counties, we see similar patterns. Those more agreeing ideologically with governmental and conservative parties value the European Union and Ukraine lower, while opposition voters have a more positive opinion about them. (See Table 3.) The data are showing a trend, we see opposing view in the case of governmental and opposition voters.

**Table 3:** Pearson Correlation values of the researched parties and the countries

	IDEFID	IDEDK	IDEMSZP	IDEMOM	IDEJOB	IDEMKKP	IDELMP	IDEMIH
EU	-,348*	,251**	,197**	,349**	0,014	,176*	,196**	-,215*
USA	-0,124	,145*	,195**	,171*	0,031	0,004	-0,007	-0,052
RUS	,440**	-0,001	0,057	-0,077	,218**	-,164*	0,001	,459**
UKR	-,210*	0,122	0,141	,295**	0,030	0,130	,219**	-0,104

Source: Own editing  
According to the primary study

When considering demographic data on country image, only age has a weak effect on the countries. Older participants have a more favourable view of the European Union and age effects negatively the Russian Federation. This might be happening because of historical reasons. The image of Ukraine and the United States has no connection to any of the demographic indicators.

## 7. CONCLUSIONS AND DISCUSSION

Countries use a variety of practices to influence public opinion, including propaganda, framing and narrative (Agenda setting). This is especially important when military confrontations are happening, when domestic and foreign audiences need to be persuaded.

During the primary study, the data indicates that communication channel trust has a strong correlation with political party preference, according to ideological views. This means that which party a person favours will have an effect on where information and news will be gathered from, which channels will be considered as credible news sources. The more pro-governmental and conservative political preferences the person has, the higher trust is visible at public service and classical offline channels, while in the case of opposition voters, online and social media channels are preferred and considered as credible. Thus according to political and ideological affiliation, on these channels different narratives can be presented to the public that can affect the country image itself.

From the data it can be deduced that public opinion is polarised about the researched states, all in a trend like fashion along the pro-government/conservative and opposition/liberal political line. The first group will have a more positive opinion about the Russian Federation and a more negative one about the European Union, while the second group will show opposite patterns, have a more favourable opinion about the EU and Ukraine. The image of the USA is the least influenced by communication channel trust and political affiliation, but in a similar trend. When considering demographic markers, no significant correlation and no trends can be found, except for a weak impact of age.

Because of the patterns, it is presumed that from a governmental and conservative political platform, and the channels that these organisations use (classical-offline), the voters are presented with narratives that have an elevating effect on the image of the Russian Federation, and a decreasing one on the European Union and Ukraine. Opposite patterns are

visible when considering opposition and liberal political spectrums, and online communication channels. This has an elevating effect on the EU and Ukraine, and a decreasing one on Russia.

The analysis shows patterns and correlations, but it doesn't provide us with a clear cause and effect explanation. It is not clear whether communication channel trust has an effect on party preference, thus different media channels drive their target audiences towards certain political organisations that have the same ideological views and narratives as the channel provider. Or if parties have connections and relationships with some of the communication channels, thus the media mimics the narratives that these organisations promote, they provide more place for these selected views to be shown. At the moment it is the presumption that the second one is more likely, but further research will be needed to gain a deeper understanding of the question.

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**Julija Vidosavljević**University of Kragujevac, Faculty of  
Economics  
Kragujevac, Serbia

e-mail: jvidosavljevic19@gmail.com

**Veljko Marinković**University of Kragujevac, Faculty of  
Economics  
Kragujevac, Serbia  
University of Belgrade, Faculty of Economics  
Belgrade, Serbia

e-mail: vmarinkovic@kg.ac.rs

## **ANALYSIS OF USERS' ATTITUDES TOWARDS THE USE OF MOBILE TECHNOLOGIES IN REPUBLIC OF SERBIA**

**Abstract:** The increasing use of mobile devices and wireless internet connections has led to their utilization, not only for communication purposes, but also for various other activities, such as mobile commerce (m-commerce). Contemporary trends have enabled m-commerce to become a business model with the potential to transform entire industries. Alongside technological advancements, there is an evolution of models explaining consumer behavior in the domain of technology acceptance. The original TAM model and its extensions, although providing useful insights, do not encompass all relevant determinants, prompting practitioners to increasingly turn to more contemporary models in order to understand the acceptance and usage of mobile technologies in today's digital environment. UTAUT2 model is considered an improved version of the original UTAUT model, making it one of the most used models. Considering the above-mentioned, the research aims to measure users' attitudes towards various aspects of mobile commerce usage. In this context, consumers' attitudes towards performance expectancy, effort expectancy, social influence, facilitating conditions, price value, hedonic motivation, and habit in using m-commerce will be examined. Additionally, the aim of the study is to analyze the attitudes of different consumer segments, based on two criteria - gender and age. The sample consists of 210 respondents. The research was conducted in the territory of Central Serbia, from April to May 2023. Descriptive statistical analysis, reliability analysis, and t test for two independent samples were applied in the research. The research findings can be useful to mobile commerce service providers in adjusting loyalty programs to different segments, providing added value, and shaping the overall user experience that appeals to various consumer segments. Given that previous research, especially in domestic literature, has been based on some of the previously established models such as TAM or UTAUT, the originality of this study lies in the use of the contemporary UTAUT2 model. Additionally, the originality is contributed by the comparative analysis of different segments of m-commerce service users.

**Keywords:** mobile commerce, UTAUT2, performance expectancy, effort expectancy

### **1. INTRODUCTION**

The eighties are widely recognized as the era when personal computers gained prominence, followed by the nineties which saw the emergence of the internet and e-commerce. The early 21st century witnessed the ascent of mobile computing and mobile commerce. Mobile commerce, or m-commerce, specifically refers to financial transactions conducted via mobile networks, while in a broader sense, it encompasses all applications and services supported by mobile devices and networks (Urbaczewski et al., 2003). Today, with the ubiquity of mobile devices and wireless internet connections, m-commerce is reshaping industries and becoming a prevalent mode of conducting business (Chong, 2013).

Presently, nearly 7 billion individuals own smartphones, roughly accounting for 80% of the global population. The popularity of e-commerce as a method for purchasing goods and services is on the rise among the citizens of the Republic of Serbia. There is an undeniable increase in the number of internet users in the country day by day. This trend

is expected, considering that owning a smartphone is nearly obligatory nowadays, and the previous barriers to its usage, whether financial or technical, have largely disappeared (MasIT, 2021). The mobile phone usage in Serbia stands at 95.5% and continues to rise, with the elderly population being the primary demographic without mobile devices. Serbia surpasses the global average in terms of mobile device ownership, boasting a penetration rate of 123.9%, meaning there are 123 mobile devices per hundred inhabitants (Statistical Office of the Republic of Serbia, 2022), with the elderly population being the main demographic lacking mobile devices.

The largest e-commerce markets include China (52%), the USA (12%), the United Kingdom (4.8%), and Japan (3%) (Business.com). Serbia reflects these global e-commerce trends, with experts forecasting over 20% growth in internet shoppers. Presently, around four million consumers in Serbia make online purchases, indicating significant potential for e-commerce development (PlutonLogistics). According to the Statistical Office of the Republic of Serbia (2023), 42.3% of users bought a product online in the last three months, while 39% of the population has never engaged in online purchases. Globally, 79% of smartphone users have made purchases through their mobile devices, and it is projected that mobile commerce will constitute 42.9% of total e-commerce (Oberlo, 2022; eMarketer, 2023).

Use and adoption-related issues have been continually scrutinized because the new technologies are developing constantly and finding their place both in society and organization, finding their roles within society and organizations, and the persistent high failure rate of information systems (Dwivedi et al., 2015). Understanding the adoption of new technologies is complex and influenced by various factors. Studies, particularly those related to mobile commerce adoption, often employ intention-based models rooted in cognitive psychology. One such contemporary model is the UTAUT 2 model (Unified Theory of Acceptance and Use of Technology) (Venkatesh, 2013), which forms the basis of this paper.

The significance of the UTAUT 2 model is indicated by a large number of studies in the field of m-commerce (Farzin et al. 2021; Kalinić et al. 2019; Shaw & Sergueeva, 2019; Chimborazo et al. 2021), e-commerce (Zhou et al. 2021; Dutta & Shivani, 2020) and m-banking (Farzin et al. 2021; Alalwan et al. 2017; Alalwan et al. 2018).

Given the significance of mobile commerce in the contemporary environment, the aim of the paper is to measure users' attitudes towards the use of mobile commerce. Within this framework, consumers' attitudes towards performance expectancy, effort expectancy, social influence, facilitating conditions, price value, hedonic motivation, and habit in using m-commerce will be examined. Furthermore, the aim of the study is to analyze the attitudes of different consumer segments, based on two criteria - gender and age. The sample consists of 210 respondents. The research was conducted in the territory of Central Serbia, from April to May 2023. Descriptive statistical analysis, reliability analysis, and t test for two independent samples were applied in the research process.

The paper is structured into several parts. After the introductory section, the second part of the paper covers the evolutionary development of the technology acceptance model, with a focus on the UTAUT2 model. The third part of the paper includes an explanation of the research methodology used, while the fourth part presents the results of the conducted research. The conclusion discusses the theoretical and practical implications and highlights the limitations and directions for further research.

## 2. TECHNOLOGY ACCEPTANCE MODELS

Due to consistent effort to understand issues related to adoption and diffusion, numerous theories have been developed, adapted or adopted in modern literature to describe acceptance and use of technology in several contexts (Morosan, 2014; Dwivedi, et al. 2015). One of the most commonly used models in research is the Technology Acceptance Model (TAM), introduced by Davis and colleagues (Davis, 1989; Davis et al. 1989), which is based on the Theory of Reasoned Action (TRA) (Ajzen & Fishbein, 1980). The TAM model is employed to model the acceptance of information systems by users. The primary goal of this model is to track the influence of external factors on internal beliefs. According to TAM, two key determinants - perceived usefulness and ease of use - are of paramount importance for the acceptance of a new system or technology, defined as the feeling of favorability or unfavorability (Min, Ji & Qu, 2008).

While TAM has been extensively employed in early studies, it possesses inherent limitations, notably its inability to comprehensively explain the adoption and utilization of mobile technology (Molina-Castillo, López-Nicolás & Bouwman, 2008). Moreover, the model accounts for only 40% of the variance in information system usage and overlooks several crucial factors pivotal in technology acceptance (Chong, 2013).

The technology acceptance model (TAM) serves as the basis (Bakhsh et al., 2017) for later versions (TAM 2 and TAM 3) (Venkatesh & Davis, 2000; Venkatesh & Bala, 2007), which extend TAM by incorporating numerous variables to explain perceived usefulness (e.g. image, job relevance and subjective norm) and perceived ease of use (e.g. computer anxiety, self-efficacy and playfulness), respectively (Pipitwanichakarn, & Wongtada, 2019).

Venkatesh (2003) presented the Unified Theory of Acceptance and Use of Technology (UTAUT) model, aiming to provide a more nuanced understanding of technology adoption by merging eight theories in this domain. Where performance expectancy posits benefits to a user of using a technology, effort expectancy posits the ease to use the technology by a user, social influence posits the significance of people (such as friends and relatives) who are important to a user while using a technology and facilitating conditions refer to the resources and support system accessible to a user using a technology (Chhonker et al. 2017). The theory also provides the four moderators namely: age, gender, experience and voluntariness of use (Venkatesh, 2003). The UTAUT approach is particularly valuable for two reasons.

Firstly, it consolidates theoretically and empirically relevant variables from various models to describe users' acceptance (Venkatesh et al., 2003). Secondly, it offers flexibility in conceptualizing mobile commerce acceptance by incorporating additional factors into the technology acceptance framework (Hino, 2015). Despite providing a detailed explanation of technology acceptance and use, even the UTAUT model has its limitations (Negahban & Chung, 2014). In response, Venkatesh et al. (2012) proposed the Extended Unified Theory of Acceptance and Use of Technology – UTAUT 2. This model introduces seven variables, expanding upon the original UTAUT model (Venkatesh et al., 2003) to include hedonic motivation, price value, and habit. By integrating these factors, the model became more consumer-oriented compared to UTAUT (Tak & Panawar). Price value holds significance for consumers in service usage, habit plays a fundamental role in the adoption of new technology based on prior research, and hedonic value has been extensively examined in previous studies (Kim & Malhotra, 2005), as emotions such as enjoyment and satisfaction play a part in the process of adopting new technologies (Kulviwat, 2009). In compare to UTUAT, UTAUT2 have shown a considerable change in variance, as variance explained in behavioral intention improved from 56% to 74% and variance explained in technology use improved from 40% to 52% (Chang, 2012). Taking all of the above into account, the UTAUT2 model has become the benchmark in technology acceptance (AlAwadhi & Morris, 2008; Imtiaz, 2018).

### 3. RESEARCH METHODOLOGY AND SAMPLE STRUCTURE

The research was conducted in the territory of Central Serbia from May 5th to May 15th, 2023. The sample consisted of 210 participants, segmented based on: gender, age, level of education, employment status, and income level. The research was conducted electronically via a Google Form survey. Respondents expressed their level of agreement with statements on a five-point Likert scale ((ranging from 1 - strongly disagree to 5 - strongly agree). The questionnaire included 25 statements, sourced from relevant studies, grouped into 7 factors. To ensure representativeness, the sample's gender and employment distributions roughly mirrored those used in the Statistical Office of the Republic of Serbia's analysis of mobile commerce users (2022). Out of the 210 respondents, 53,81% are female and 46,19% are male. Respondents are predominantly aged 18 to 24 (35.71%), with monthly earnings ranging from 40,000 to 80,000 RSD (36.67%). Regarding educational background, the highest proportion of respondents held a university degree (44.76%). Data processing was conducted using the statistical software SPSS v20. The software was used to carry out appropriate statistical analyses. First, measures of descriptive statistics (mean and standard deviation) were employed to determine the favorability and homogeneity of respondents' attitudes regarding the statements from the questionnaire. The reliability of research variables was determined through reliability analysis.

### 4. RESEARCH RESULTS

Based on the results of descriptive statistics presented in Table 1, it can be concluded that there is the highest degree of agreement regarding the statement: "Mobile commerce is easy to use" (highest mean value - 4.25), and the lowest when it comes to the statement: "I am one of the first to try mobile commerce" (lowest mean value - 3.08). Respondents' attitudes are most homogeneous for the statement "Mobile commerce systems deliver on their promises." (lowest standard deviation value - 0.94), and most heterogeneous in the case of the statements "Mobile commerce is useful to me in everyday life" and "Using mobile commerce helps me quickly complete transactions" (highest standard deviation value for both statements - 1.24).

**Table 1:** Results of descriptive statistical analysis

Statements	Mean	SD
1. Mobile commerce is useful to me in everyday life.	3.87	1.24
2. Using mobile commerce helps me quickly complete transactions.	4.09	1.24
3. Using mobile commerce enhances my productivity.	3.81	1.22
4. It is easy to learn how to use mobile commerce.	4.24	1.04
5. Mobile commerce is easy to use.	4.25	1.05
6. The use of mobile commerce is clear and understandable.	4.15	1.04
7. Skills in using mobile commerce are easily acquired.	4.20	1.02
8. People who influence my behavior think I should continue to use mobile commerce.	3.63	1.15
9. My friends think I should continue to use mobile commerce.	3.76	1.08
10. Mass media influences me to use mobile commerce.	3.36	1.29
11. I have the resources necessary to use mobile commerce.	4.20	1.10
12. I have the knowledge necessary to use mobile commerce.	4.17	1.12
13. Using mobile commerce is compatible with other technologies I use.	4.12	1.04
14. I can rely on others' help when I have difficulty using mobile commerce.	4.02	1.01
15. I trust mobile commerce systems.	3.83	0.97

16. Mobile commerce systems provide services in my interest.	3.99	0.96
17. Mobile commerce systems deliver on their promises.	4.04	0.95
18. Information provided through mobile commerce systems is reliable.	3.86	1.05
19. I am one of the first to try mobile commerce.	3.08	1.38
20. I like to try new technologies.	3.82	1.23
21. I enjoy learning about new technologies.	3.89	1.20
22. Friends often ask me for advice on using new technologies.	3.53	1.30

Source: Authors' research

In order to determine customers' attitudes, the statements were grouped into factors based on similarity, followed by a reliability analysis, as shown in Table 2. Based on the values of the Cronbach's alpha coefficient, it can be concluded that all factors are reliable, as the coefficient value for each factor exceeds 0.7 (Nunnally, 1978). The highest degree of internal consistency of statements is observed in the "Effort Expectancy" factor (highest Cronbach's alpha coefficient value - 0.957), while the lowest degree of internal consistency occurs in the case of the "Social Influence" factor (lowest Cronbach's alpha coefficient value - 0.837).

**Table 2:** Reliability analysis

Factors	Mean	SD	Cronbach's alpha
Performance expectancy	3.92	1.13	0.906
Effort expectancy	4.21	0.98	0.957
Social influence	3.58	1.02	0.837
Facilitating conditions	4.13	0.88	0.839
Hedonic motivation	3.73	1.03	0.913
Price value	3.91	0.88	0.895
Habit	3.32	1.13	0.833

Source: Authors' research

To ascertain if there are statistically significant differences in respondents' attitudes regarding the given variables, an independent samples t test for two independent samples was conducted. The criterion by which respondents' attitudes were grouped is their gender and age.

**Table 3:** T test for Two Independent Samples

Factors	Sig.	Mean	St. deviation	Gender
Performance expectancy	0.051	3.970	0.096	female
		3.856	0.131	male
Effort expectancy	0.09	4.344	0.077	female
		4.028	0.118	male

Source: Authors' research

Based on the results of the analysis shown in Table 3, a statistically significant difference exists in respondents' attitudes concerning two factors: Performance expectancy ( $p = 0.051 < 0.1$ ) and Effort expectancy ( $p = 0.09 < 0.1$ ). In both instances, the attitudes of female respondents were notably more favorable, as indicated by the mean values.

**Table 4:** T test for Two Independent Samples

Factors	Sig.	Mean	St. deviation	Gender
Performance expectancy	0.096	3.946	1.069	younger
		3.885	1.233	older
Effort expectancy	0.026	4.295	0.872	younger
		4.080	1.120	older

\*Younger respondents (18-45 years of age); older respondents (45 and older)

Source: Authors' research

When it comes to respondents' age, based on the results of the t test for two independent samples shown in Table 4, a statistically significant difference exists in respondents' attitudes concerning two factors: Performance expectancy ( $p = 0.096 < 0.1$ ) and Effort expectancy ( $p = 0.026 < 0.1$ ), where in both cases (considering the mean value), the attitudes younger employees are more favorable.

## 5. CONCLUSION

Undoubtedly, today all forms of electronic commerce are becoming increasingly popular and slowly threatening to surpass traditional shopping methods. With the growing use of mobile devices, mobile commerce is becoming the preferred means of conducting electronic transactions. Presently, the popularity of e-commerce is increasing among the citizens of the Republic of Serbia as the number of internet users continues to grow steadily. The widespread use of smartphones contributes to this trend, as owning a smartphone is almost mandatory nowadays, with previous barriers to usage largely disappearing. In line with these rising trends, there is an evolution of models that explain consumer behavior in the realm of adopting new technologies. One of the most commonly used models, emerging as a result of integrating numerous preceding ones, is the UTAUT2 model, which became the benchmark in technology acceptance. Besides traditional models, the UTAUT 2 model stands out, which, unlike the previous ones, includes the highest number of variables and primarily focuses on consumers. This ensures a more comprehensive understanding of user behavior and attitudes in mobile commerce contexts.

The paper aims to examine consumers' attitudes towards performance expectancy, effort expectancy, social influence, facilitating conditions, price value, hedonic motivation, and habit in using m-commerce. Additionally, the aim of the study is to analyze the attitudes of different consumer segments, based on two criteria - gender and age. What sets this paper apart is its utilization of the UTAUT 2 model, known for its contemporary relevance and broader scope, incorporating additional variables compared to the traditional UTAUT or TAM models.

The conducted research has the following theoretical and practical implications. Primarily, it enables the expansion of existing knowledge regarding users' attitudes towards mobile commerce usage. The contribution of the conducted research is reflected in the following practical implications. Considering that respondents' attitudes are least favorable when it comes to the habit of using mobile commerce, it is important to transform occasional usage of mobile commerce into a habit. This can be achieved through loyalty programs where certain benefits apply only for purchases made through the installed application on the phone, thereby stimulating consumers to use mobile commerce more regularly compared to traditional shopping. Social influence can be particularly encouraged in the initial stages of adopting new technologies when users lack personal experience and rely on the opinions of others. To encourage users to use mobile commerce more, it is desirable to promote positive word-of-mouth from friends and acquaintances. Users' attitudes towards importance of hedonic motivation can be increased through their involvement in the product presentation process (e.g., a special section on the page that pulls images from social media platforms where the user tagged the company). When it comes to price value, the consumers' attitudes companies can offer free delivery, loyal customer discounts, and loyalty programs to boost purchases, along with personalized offers and early access to discounted products. In order to improve positive attitudes towards perceived performance of m-commerce services, companies could emphasize the benefits of mobile commerce compared to other types of commerce through extensive marketing efforts. Facilitating conditions, crucial for user satisfaction, involve necessary knowledge, resources, and compatibility with existing technologies. M-commerce service providers should offer user-friendly software that integrates seamlessly with other solutions. The most positive attitudes of users occur when it comes to effort expectancy in using mobile commerce technologies. However, considering their influence on usage intention, it is possible to further facilitate usage by providing text or video instructions for performing mobile commerce, which will enable users to more easily master the use of this technology.

Based on the obtained results, it can be concluded that there are differences in attitudes between men and women regarding performance expectancy and effort expectancy. To improve male attitudes towards performance expectancy and effort expectancy it is possible to highlight the advantages of using mobile commerce through campaigns that explain the benefits and functionalities of m-commerce platforms with a focus on simplified purchasing of products/services commonly used by men.

When it comes to the attitudes of respondents belonging to different age groups, it can be concluded that younger participants exhibit more positive attitudes compared to older ones. The obtained results are consistent with the fact that despite the growing number of mobile device users, the least represented segment consists of older users. Comparing traditional shopping with mobile shopping by providing detailed instructions, as well as offering benefits for retirees, can contribute to more positive attitudes among older users. The conducted research has several limitations. The primary limitation stems from the size and structure of the sample, which is not sufficiently representative, as the study was conducted only in the territory of Central Serbia and includes a relatively small number of participants. Second, the study included only the variables of the UTAUT 2 model. Therefore, future research could include one or more dependent variables such as the intention of future use, or customer satisfaction or loyalty in order to determine their behavior. Future research could also involve participants from neighboring countries to compare with this study. Additionally, it is possible to use more segmentation criteria such as level of income or educational background.

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### **Daniela Nuševa**

Faculty of economics in Subotica, University  
 of Novi Sad  
 Subotica, Serbia  
 daniela.nuseva@ef.uns.ac.rs

### **Radenko Marić**

Faculty of economics in Subotica, University  
 of Novi Sad  
 Subotica, Serbia  
 radenko.maric@ef.uns.ac.rs

### **Ksenija Leković**

Faculty of economics in Subotica, University  
 of Novi Sad  
 Subotica, Serbia  
 ksenija.lekovic@ef.uns.ac.rs

### **Dražen Marić**

Faculty of economics in Subotica, University  
 of Novi Sad  
 Subotica, Serbia  
 drazen.maric@ef.uns.ac.rs

### **Sonja Vučenović**

Faculty of economics in Subotica, University  
 of Novi Sad  
 Subotica, Serbia  
 sonja.vucenovic@ef.uns.ac.rs

### **Goran Vukmirović**

Faculty of economics in Subotica, University  
 of Novi Sad  
 Subotica, Serbia  
 goran.vukmirovic@ef.uns.ac.rs

## **THE IMPACT OF DIGITALIZATION ON SUSTAINABLE FOOD SUPPLY CHAIN MANAGEMENT<sup>1</sup>**

**Abstract:** The food supply chain includes all activities from the transformation of inputs to the creation of the final product and its consumption, that is, all activities from the farm to the retail shelf. With the increase in complexity, actors in food supply chains face greater risks in the market so they must follow the latest trends and changes in the food market, and react quickly to challenges. In addition to economic, food supply chain management faces sustainability challenges as well. Instead of focusing only on their own growth and expansion, actors in food supply chains must consider how their business affect the environment and the interests of their communities. On the other side, consumers demand realtime updated information on food they consume and they want to know if the food they are consuming is environmentally and socially sustainable or not. For this reason food product traceability, safety and sustainability issues have become a crucial concern to food retailers and everyone else in the food supply chain. The aim of this paper is to point out digitalization as a solution to those issues. Particularly blockchain as an emerging transformative technology for supply chain management. Secondary data and methods of induction, deduction, synthesis and analysis were used for the purpose of writing this paper.

**Keywords:** Digitalization, blockchain, sustainability, food, supply chain, management

## **1. INTRODUCTION**

Globalization and internationalization of business in synergy with other processes, such as: the development of information and telecommunication technology, the improvement of logistics capacities, the increase in consumers' awareness and information, the importance of ethical issues, etc., have led to strong competition on the world market. Achieving a significant competitive advantage, and especially its preservation and improvement, represent one of the biggest challenges for every company. The relentless struggle to win and retain customers has led to a number of competitive strategies, from those focused at the lowest possible costs to those focused at achieving differentiation and premium pricing (Porter, 2007). Basically, company need to create more value for its customers, and to manage its operations more efficiently than its competitors.

The search for the most successful competitive strategy has led to an increase in awareness of the companies' dependence on its stakeholders. The company is not an isolated market player whose business results are outcome of solely its individual efforts. On the contrary, its business results are largely determined by the effectiveness of the

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<sup>1</sup> The paper is part of a research for short-term project of interest for the development of scientific research activities in AP Vojvodina in 2023, titled „The application of artificial intelligence in the function of the sustainability of the supply chain of food products on the market of the AP Vojvodina“.

activities of its suppliers, intermediaries, retailers, etc. It is actually part of the wider supply chain as a network of organizations with which it establishes appropriate relationships. The ways of establishing cooperation and coordination with its business partners, often are a dominant factor in company's business success. In accordance to that, in modern business, competition between different supply chains in relation to competition between different companies is becoming more important for achieving and maintaining market share. These ideas represent one of the foundations of the development of supply chain management.

The world is well into its Fourth Industrial Revolution (Industry 4.0) where many things, including food, are affected by emerging technologies (Amentae & Gebresenbet, 2021). Digitalization has been emphasized as a key factor to bring supply chains into the new era. Food supply chains can overcome key challenges such as traceability, safety and sustainability by applying one or more modern technologies. In this paper, the emphasis is on blockchain technology by which every important product information can be collected, stored and shared with the actors involved in the supply chain from the first phase to the final consumer (Kurucz et al., 2021).

The paper is organized as follows: section 1 contains introduction; section 2 explains development of supply chain management; section 3 provides insight into key issues of sustainable food supply chain management; section 4 describes the impact of digitalization on the transformation of food supply chains and it also provides an overview of blockchain; section 5 represents the conclusion of this desk research.

## 2. DEVELOPMENT OF SUPPLY CHAIN MANAGEMENT

Supply chain management, as a recent phenomenon arised in the 1980s, is in the focus of the economic theory and practice today. It indicates the need to integrate and manage movements of materials from numerous suppliers, through intermediaries, all the way to numerous end customers. Supply chain management strategy today must be indispensable part of every successful business strategy, and that requires long-term internal and external integration among the actors of the supply chain, which implies sharing of interests, processes, information, risks, rewards, etc (Arredondo & Alfaro Tanco, 2021, p. 13). The basic characteristics of supply chain management include (Mentzer et al., 2001, p. 7):

- "A systems approach to viewing the supply chain as a whole, and to managing the total flow of goods inventory from the supplier to the ultimate customer;
- A strategic orientation toward cooperative efforts to synchronize and converge intrafirm and interfirm operational and strategic capabilities into a unified whole; and
- A customer focus to create unique and individualized sources of customer value, leading to customer satisfaction."

The emergence and evolution of supply chain management was influenced by the development of other phenomena. One of them is the need for a "holistic approach" or internal alignment that implies recognition of the importance of coordinating various functions within the organization. In addition, the increase of worldwide business activities has forced companies to turn to global sourcing, so they had to find more effective ways of developing and maintaining long-term relationships with their remote suppliers and customers. Other factors, such as the development of information and telecommunication technology, social networks, corporate social responsibility, geopolitical turbulence, etc. resulted in increasing consumer demands regarding the time and quality of deliveries. Fast delivery, exactly on time, became a necessary condition for market survival.

It is of an immense importance to understand the relationship between supply chain management and logistics management, because supply chain management originated from the concept of logistics and is deeply connected to it. Supply chain management includes logistics management, so it represents a broader concept (Council of Supply Chain Management Professionals, 2023). Unlike logistics, that is focused at the the movement of materials at the level of one business entity, in the focus of supply chain management are all the movements within one supply chain of a certain distribution channel (Božić & Aćimović, 2021, p. 17). It includes all aspects of the product life cycle, so it implies coordination between the business functions of logistics, marketing, production, finance, product design, etc. Given that product life cycles are getting shorter and shorter, the company's ability to respond quickly and flexibly to customer demand is an important source of competitive advantage in modern business conditions. The availability of the product on the market thus becomes a factor that is of a great influence for the customer when making a decision to purchase a certain brand, or when making a decision about its potential substitution with another brand in situations when the product is not available. Therefore, all activities within the supply chain must be viewed as a whole, and the main goal of supply chain management must be to achieve a sustainable competitive advantage. Logistics management must be oriented towards the complete satisfaction of consumer needs.

It is also necessary to point out the difference between the terms supply chain and supply chain management. A supply chain involves a series of processes (decision making and execution) and flows (materials, information and money) that aim to fulfill the requirements of end customers and that take place within and between different stages of the supply chain (Worst, 2004, p. 3). It includes all actors, regardless of whether they contribute to the satisfaction of consumer needs directly or indirectly. The number of actors in a given supply chain can vary, and accordingly it can be more or less complex. It is most often made up of the manufacturer, its suppliers, transporters, warehouse, wholesalers, retailers and other intermediaries, as well as the consumers themselves. Therefore, every company belongs to a specific

supply chain because it can not operate in the market without appropriate partner relationships. Even more, each company is simultaneously part of several supply chains within which it realizes multiple business connections. Interconnections between individual actors within a supply chain can be of different strength and intensity depending on the importance that certain partners have for each actor. Therefore, it is very important to manage mutual connections, i.e. supply chain. This is precisely what makes the fundamental difference between supply chain and supply chain management, because a supply chain can exist without being managed. Effective supply chain management involves achieving appropriate speed, reliability, flexibility and cost in meeting customer requirements (Janvier-James, 2012). To be effective, all links between the actors within the chain must function well. Therefore, all connections must be controlled in order to have a higher level of integration.

### **3. KEY ISSUES OF SUSTAINABLE FOOD SUPPLY CHAIN MANAGEMENT**

It is important to emphasize that food supply chain management is of an immense importance because food is necessary for human lives, and therefore food production and distribution represent significant part of every national economy. In 2023, the high-income and upper-middle-income countries comprised the major share of the global food import bill estimated around 2 tn US\$, with 62 % and 25 % respectively (Food and Agriculture Organization of the United Nations, 2023, p. 83). The global food market in 2024 was valued 10.07 tn US\$, its expected annually growth 6.53% (CAGR 2024-2028), and the value added 1.14 tn US\$ (Statista, 2024).

The food supply chain includes all activities from the transformation of inputs to the creation of the final product and its consumption, that is, all activities from the farm to the retail shelf, such as: agricultural production, processing, packaging, marketing, storage, transport, retail, consumption, etc., but also waste disposal. Therefore, it is comprised of a large number of actors, operations and processes, which aim is food availability at the right time, right place, right price, right quality and right quantity. Food supply chains are complex because of the very nature of food as a commodity, that is its perishable to a greater or lesser extent, and it implies appropriate terms of use, ways of storage and/or consumption. In addition, the increase in the complexity of food supply chains is influenced by the growing number of actors, operations and processes; increasing physical distance between actors; implementation of strict quality, health and safety standards; etc.

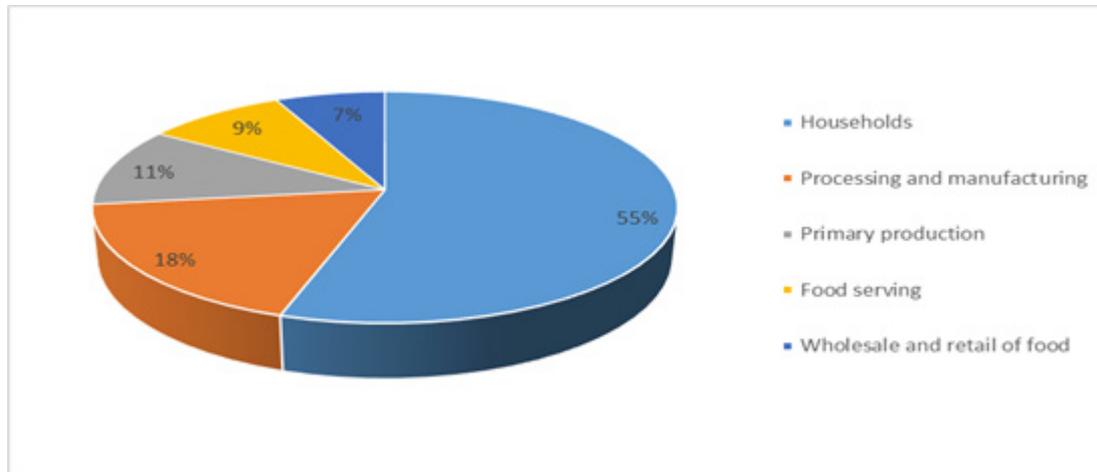
With the increase in complexity, actors in food supply chains face greater risks in the market, so they must follow the latest trends and changes in the food market, and react quickly to challenges. To achieve this, successful management of food supply chains is crucial. According to Zhong, Xu & Wang (2017, p. 2086) food supply chain management "has been coined to depict the activities or operations from production, distribution, and consumption so as to keep the safety and quality of various food under efficient and effective modes".

In an efficient and effectively managed food supply chain is extremely important that each individual actor contributes by implementing their business operations and processes in the most optimal way. This means creating added value at the lowest possible costs. The Global Supply Chain Forum has precisely emphasized this aspect in its definition of supply chain management as "the integration of key business processes from the end user through original suppliers that provides products, services and information that add value to customers and other stakeholders" (Lambert & Cooper, 2000, p. 66). Added value is created at each stage of the value chain (Porter, 2007). Therefore, food supply chain management implies permanent efforts to increase the efficiency of the operations of all individual actors, while at the same time improving the coordination and optimization of their mutual connections, in order to generate the maximum total value at the level of the entire chain. This total value of the supply chain is defined as the difference between the value that the final product has for the consumer and the costs of the entire supply chain incurred to satisfy the consumer's demands (Chopra & Meindl, 2016, p. 15). The total value generated by a given supply chain must be greater than the simple sum of the individual values generated by its actors, i.e. there must be a synergistic effect.

In addition to economic, food supply chain management faces sustainability challenges as well. Instead of focusing only on their own growth and expansion, actors in food supply chains must consider how their business affects the environment and the interests of their communities. They have to be responsible and behave in a way to satisfy "the needs of the present without compromising the ability of future generations to meet their own needs" (World Commission on Environment and Development, 1987). Their approach in identifying, adopting and responding to sustainability issues must be proactive. But not only that they have to be responsible for their own behaviour, actors should also use their power to influence other business entities operating within and outside their food supply chain to adhere to sustainability principles.

Sustainable development incorporates three dimensions: economic, environmental and social. The economic dimension refers to profitability, innovations, productivity, return on investments, etc. The environmental dimension includes use of energy sources, carbon footprint, loss and waste, plastics pollution, etc. The social dimension considers pay scales, labour conditions, ethical issues, community welfare, etc. When establishing a sustainable food supply chain, it is necessary to take into account all the three dimensions and their interaction with each other. Therefore, a sustainable food supply chain must be profitable and competitive on the market while incorporating social and environmentally responsible business practices of its actors.

For example, one of the major challenges to sustainable food supply management is food loss and waste. It is estimated that losses between harvest and retail represent 13%, and that households, food service and retail waste amount around 17% of the globally produced food (United Nations, 2024). But the value of food loss and waste is only part of a wider problem. Food loss and waste include in themselves all the invested resources as well as all the negative consequences of the environmental pollution during all the stages and movements in the food supply chain, from raw materials to final product. As the graph 1 shows in the structure of European Union's waste in 2020, households dominated, generating around 70 kilograms per inhabitants.



**Graph 1:** Food waste in the European Union, 2020  
**Source:** Eurostat, 2022, p. 101

In order to achieve sustainability, and to eliminate incidents, frauds and scandals, the implementation of a traceability system in food supply chains is of invaluable importance. Traceability is defined as "ability to follow the movement of a feed or food through specified stage(s) of production, processing and distribution" (International Organization for Standardization, 2007). It is believed that the scandal known as "mad cow disease" that occurred in the United Kingdom in 1986 raised the issue of traceability and prompted the adoption of the EU food Regulation No 178/2002 or the General Food Law Regulation. The Regulation establishes the general principles and requirements of safe food and feed, and it covers all stages of food and feed production and distribution (Pettoello-Mantovani & Olivieri, 2022, p. 1). The food traceability system has been mandatory in the European Union since January 1, 2005, so all actors in food supply chains must implement it. They must be able to identify the origin of the food and feed ingredients, and provide that information to the authorities as quickly as possible. As sustainable food supply chains are becoming longer and more complex, with an increasing number of actors, and the distance between them becoming less relevant, the issue of trust and transparency among the actors in the supply chain is of particular importance. So, the role of each actor in sustainable food supply chains must be precisely defined. Besides that, each actor must ensure access and exchange of key and useful information to its partners.

"One step back-one step forward" or "one step up-one step down" principle is in the core of traceability. It implies that the traceability system should be set up in such a way that each actor in the sustainable food supply chain must be able to track back the traceable unit to the initial source (the first supplier), i.e. to follow the flow backwards (GS1, 2012). Also, each actor in the sustainable food supply chain must be able to follow the flow forward, to the ultimate recipient of the traceable unit (the final consumer). Although, total traceability is not required for the entire supply chain, the supplier of the traceable unit and the recipient of that same traceable unit must have the necessary documentation of at least one common level of the traceable unit. This implies that each actor in the food supply chain must keep records that represent the link between its individual activities and its traceability system. In this way, each actor is responsible only for that phase in the chain that is under its control. By connecting all stages in the supply chain, complete traceability of the entire chain is achieved.

#### **4. FOOD SUPPLY CHAIN TRANSFORMATION THROUGH DIGITALIZATION**

During the last few decades consumers have become more educated. Today, consumers demand realtime updated information on food they consume and they want to know if the food they are consuming is environmentally and socially sustainable or not. They, also put too much emphasis on food ingredients and nutritional composition (Abideen et al., 2021). On the other side, with the globalization, food supply chains became longer and more complex what made them difficult to manage (Kurucz et al., 2021). For this reason, food product traceability, safety and sustainability issues have become a crucial concern to food retailers and everyone else in the food supply chain (Gharehgozli et al., 2017).

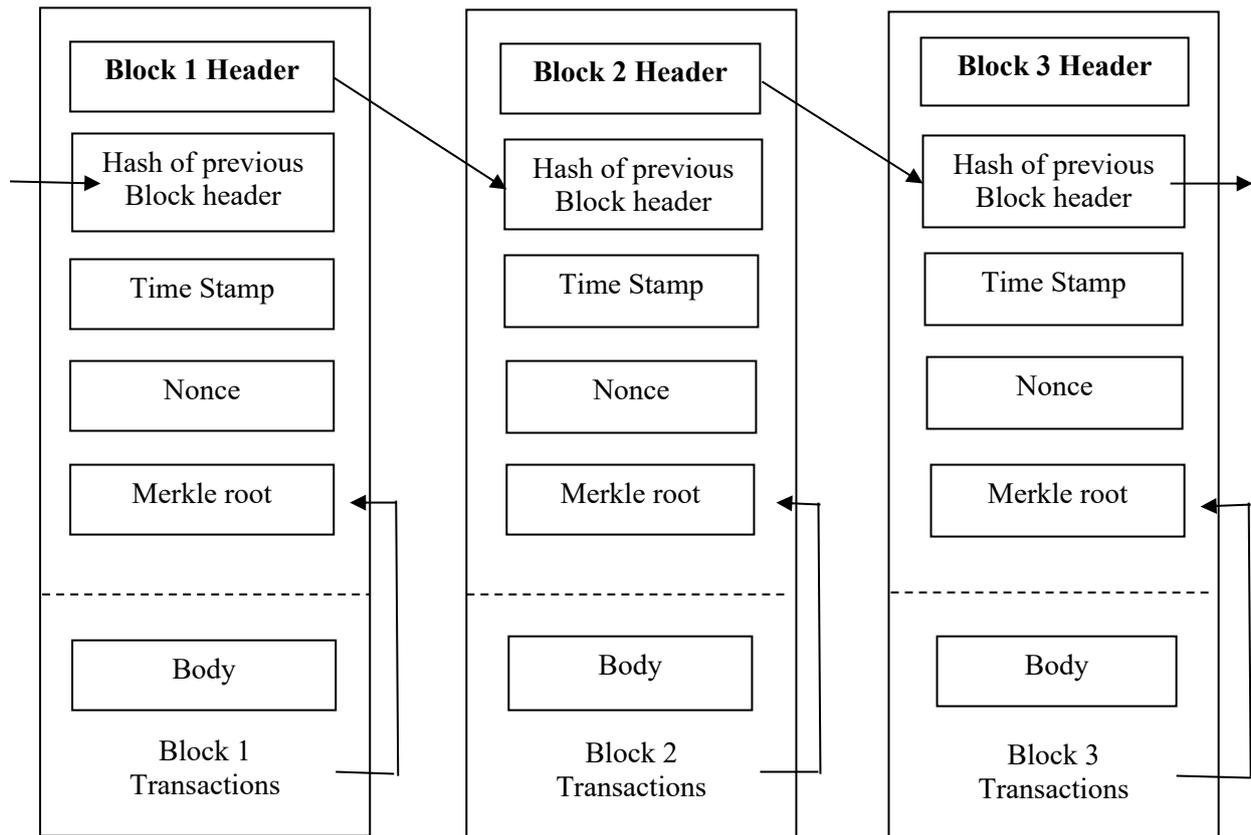
Best solution to this problem is digitalization. Why? Because it allows food supply chain to be highly connected, efficient and responsive to consumer needs and regulation requirements. Advances in digital technologies offer a way to optimize the food supply chain (Azzi et al., 2019). Likewise, the digitalization of the food supply chain has been considered a necessity to achieve sustainable competitive advantage and decrease value chain risks (Rejeb et al., 2022). Nevertheless digitalization itself is not new. Over the years several digital technologies have already been used in the food industry (Gharehgozli et al., 2017). According to Khajavi & Holmstrom (2015) the advancement of digital technologies through years and the availability of big data have enabled food supply chains to be more efficient. That's how they became more cost effective with less labour needs and mistakes along the chain. Today, digital and smart chains are reforming the food chain to help eliminate waste and improve food safety (Abideen et al., 2021).

A few years ago eight emerging technologies were proposed with the aim to transform the traditional food supply chain into a digitalized one (Kittipanya-ngam & Tan, 2019): 1) Artificial Intelligence (AI); 2) Internet of Things (IoT); 3) Augmented Reality (AR); 4) Virtual Reality (VR); 5) Robots; 6) Blockchain; 7) 3D printing; 8) Drones. In this paper, the emphasis is on blockchain technology by which every important product information can be collected, stored and shared with the actors involved in the supply chain from the first phase to the final consumer (Kurucz et al., 2021).

Why blockchain? As an emerging transformative technology for Supply Chain Management, blockchain can offer a solution to many problems such as accessibility, security, accountability and accuracy. According to Saberi et al. (2019) this technology can bring significant improvements in terms of transparency, efficiency and sustainability. It can also offer digital trust among supply chain members (Rejeb et al., 2022). Data is usually stored in time-stamped, tamper-proof, immutable and chronologically connected blocks secured with cryptography (Feng et al., 2020). After being distributed in several nodes data is completely transparent and secure providing the opportunity to the chain members to trace the product from the very beginning (Awan et al., 2021). It generates trust without the need for a trusted third party (Patel et al., 2022).

What is blockchain? Blockchain can be defined as a digitalized, decentralized and distributed ledger system for storing and sharing information (Nofer et al., 2017; Saberi et al., 2019). A distributed ledger is a database that is updated independently by each participant (node) on a large network (Prethuis & O'Malley, 2017). Each transaction in the public ledger is verified by consensus of a majority of the participants in the system (Kurucz et al., 2021). According to Patel et al. (2022) blockchain is a distributed database that stores information electronically in digital format. Blockchain records and validates user transactions that can not be altered or deleted. These actions are known as „blocks“. Each block is having its own digital signature and a connection to the previous one. That is how it creates a growing list of chronologically arranged encrypted records (Abideen et al., 2021).

Blockchain is trustworthy, decentralized, reliable and consists of blocks with sequential transactions. It consists of two parts as it is shown in Figure 1. First part – Block Header links the forward block. In this way it enables users query, monitor and examine data. Second part – Hash function that forwards blocks. This chained data structure allows each block in a blockchain to keep the previous block's contents. At the same time it injects new data at the head of the next block. Each block corresponds to a timestamped record that is verified through a defined consensus protocol of the blockchain network and secured via public-key cryptography (Seebacher & Schuritz, 2017).

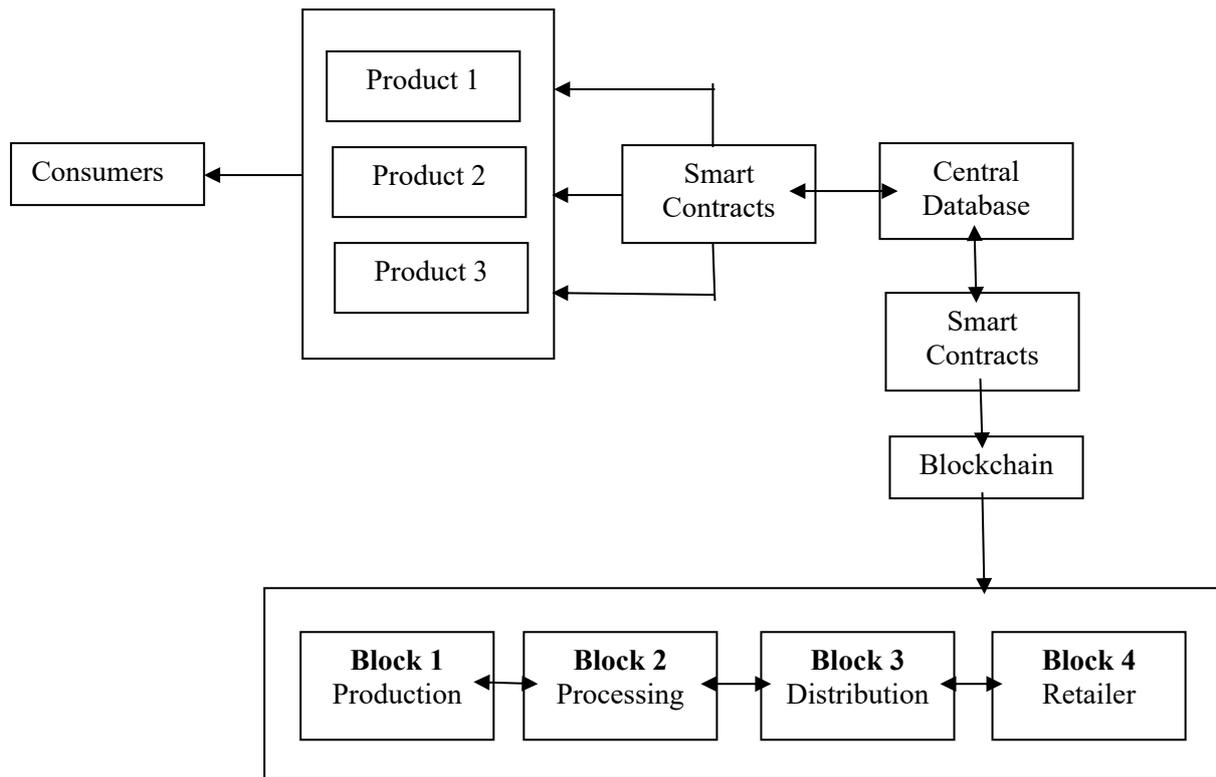


**Figure 1:** Data structure of Blockchain  
**Source:** Patel et al., 2022, p. 324

What are the main characteristics of blockchain technology? According to Christidis & Devetsikiotis (2016) those are:

- 1) Trustable exchange of information through blockchain in real time;
- 2) Accessible information to all members of supply chain;
- 3) Possibility of automatic execution of agreed transactions when certain requirements are met through smart-contract applications. Smart contracts are computer programs that can automatically execute the terms of a contract (Kurucz et al, 2021).

Blockchain in food supply chain? Figure 2 shows how does it look like when the blockchain technology is applied in the food supply chain.



**Figure 2:** Data structure of Blockchain  
**Source:** Patel et al., 2022, p. 325

Why use blockchain? Compared to traditional supply chains, where any type of data can be changed, blockchains enhance privacy. Blockchain offers data consistency and integrity. It also reduces supply chain costs.

## 5. CONCLUSION

There are always two sides to a coin, two sides to a story. It is the same now. On the one hand, we have demanding, educated consumers who are looking for realtime updated information about the food they consume. On the other side, there are food producers and retailers who face problems like food product traceability, safety and sustainability. Best solution for both sides is digitalization. Digitalization is much more than an investment in technology. It can be defined as a long-term strategic issue that requires commitment, adequate skills and resources. Application of blockchain technology in food supply chains can help both sides. It can help reduce time, operations become more traceable, food product information can be monitored and shared and, last but not least, quality of food products can be ensured.

The basic limitation of this paper is reflected in the fact that it is theoretical. Of course, as such, in future it can serve as a basis for empirical research on the application of blockchain technology in Serbia.

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**Saša Ćirić**

Student and Marketing and R&amp;D Manager

in Neoplanta,

Novi Sad, Serbia

email: [ciric.sa@neoplanta.co.rs](mailto:ciric.sa@neoplanta.co.rs)

## PRICE PROMOTIONS AND BRAND GROWTH

**Abstract:** Price is one of the important instruments in the process of marketing management. The success of investing in a brand can also be seen through its price elasticity. The price shows how the investment in the brand is capitalized, because the increase in prices, which is not initiated by the increase in costs, can be reflected in the increase in the profit of the brand. According to that, price changes, whether they are long-term or temporary, have an impact on other parameters of brand effectiveness. The aim of this paper is to try to link price actions (temporary price reductions) and long-term parameters of brand success. Special attention will be paid to long-term investment in the brand through advertising. In the first part of the paper, the author will review the theoretical framework of this topic. The second part of the work will be based on secondary data obtained by the marketing research agency GFK. Also, an effort will be made to review certain recommendations in the theoretical and practical domain.

**Keywords:** price, price promotions, price elasticity, effectiveness, brand management

## INTRODUCTION

There aren't many areas where the most renowned marketing theorists agree. Price is the tool where there is definitely a consensus that it is one of the most important in the process of marketing management (Kotler, Wong, Saunders, Armstrong, 2007; Sharp, 2016; Binet & Field, 2010). Kotler defines it as the amount of money demanded for a product or service, or the sum of values that consumers exchange for the utility of owning or using a product or service (Kotler, Wong, Saunders, Armstrong, 2007; p. 665).

Indeed, besides the most used indicators, which are directly related to brand image and awareness, there are very important indicators for measuring the effectiveness and efficiency of investment in a brand. The indicators of effectiveness include profit, sales, market share, loyalty, penetration, and price elasticity. These indicators have a significant effect on business operations and show success in the long term. While the indicators of efficiency show the achievement per unit of realized investment, i.e., how efficient the invested capital is and relate to the short term (Binet & Field, 2010)

## 2. LITERATURE REVIEW

Price is a very significant indicator for measuring the effectiveness of brand investment, and price has relation with all other indicators. Accordingly, the implications of price promotions (temporary price reductions) on key indicators of effectiveness will be explored, specifically how price affect brand growth.

### 2.1. Penetration

Penetration shows how many people have, at least once, purchased a brand or a product category within a specific time period (Sharp, 2010, p. 19). It represents one of the most important parameters for measuring the effectiveness of brand

investment, as penetration growth is crucial for brand growth. Professor Sharp, in the first and second parts of his book "How Brands Grow," emphasized the importance of penetration through several laws of customer behavior. The most significant is the law of double jeopardy, which states: brands with smaller market shares have significantly fewer customers and are somewhat less loyal in terms of purchasing and attitudes towards the brand (Sharp, 2010; Romanik & Sharp, 2016). In addition to Professor Byron Sharp, Binet and Field also highlight the importance of penetration through the analysis of 996 campaigns between 1980 and 2010 within the IPA Effectiveness Awards, noting that 47% of campaigns target the acquisition of new customers, i.e., penetration growth. The success of these campaigns in terms of sales and profit growth is significantly higher compared to campaigns targeting existing customers and focusing on loyalty (Binet & Field, 2010). Another study conducted by Kantar, one of the leading global market research companies (Kantar Worldpanel, 2023), shows that the most frequently chosen brands by consumers are those with the highest number of customers, or high penetration. Penetration is most often a relative indicator and is calculated by comparing the number of customers of a particular brand with the number of customers of all other brands in the observed category within a specific time period.

The question arises whether price promotions affect penetration growth, or brand growth? Temporary price reductions do not attract new customers; they mainly attract existing customers who purchase in larger quantities and stock up, resulting in a reduction of quantities in the future. Thus, price promotions have a temporary effect mainly on established brands (Sharp, 2010, based on Pauwels, Hanssens & Siddarth, 2022, p. 437)

## 2.2. Price Elasticity

Considering the individual importance of all four elements of the marketing mix, known as the 4Ps (Kotler, Wong, Saunders, Armstrong, 2007), price has become the most crucial instrument over the past few decades because if the price is properly set, all other activities will function effectively. When the price is not adequately determined, the brand or company will not achieve the expected profit regardless of the success of promotion, distribution, and the product that meets consumer needs. For proper pricing, or managing price as a tool for brand growth, it is very important to know its elasticity. Measuring elasticity is a key activity for marketers based on which they determine whether the price of the brand should increase or decrease. This activity greatly affects profit creation or, if not successful, leads to losses for the brand and/or company (Binet, 2022). Price elasticity is a measure of demand sensitivity relative to price, calculated by comparing the percentage change in quantity demanded with the percentage change in price (Kotler, Wong, Saunders, Armstrong, 2007; pp. 675-676).

$$\text{Price elasticity} = \% \text{ change in quantity demanded} / \% \text{ change in price}$$

For example, if demand falls by 10% in a situation where the seller raises the price by 2%, the elasticity is -5%. The minus sign confirms the inverse relationship between price and quantity demanded. In the case that the price is increased by two percent and demand falls by one percent, the price elasticity is -0.5, meaning the demand is inelastic. Generally, the lower the elasticity, the more it benefits brands to increase their prices. In this regard, price elasticity represents a very important indicator of the effectiveness of investment in a brand. The question that arises is what happens to a brand, which has an established position in the market, in the case when the price changes, whether the change is temporary (promotional prices) or a permanent change in the brand's price in the company's price list (Sharp, 2010)? Companies that are successful in creating value for consumers can capitalize part of that result through price (Kotler, Wong, Saunders, Armstrong, 2007). Accordingly, price, or its elasticity, is an important indicator for measuring the effectiveness of investment in a brand. A very important question is when the price is reduced by a certain percentage, how much will the sales of the brand increase, i.e., what is the price elasticity of the observed brand or product? Based on research mentioned in the book "How Brands Grow" (Sharp, 2010), we see that price elasticity ranges from -2.3% (Danaher & Brodie, 2000, p. 923) to -4% (Steenkamp et al., 2005). Price elasticity is always negative because it indicates a change in price that implies a change in demand in the opposite direction. The more negative the number, the greater the elasticity. If the elasticity is below -1, for example, -0.5, then the demand is inelastic, and when it is above -1, the demand is elastic. If the elasticity equals -1, then the demand is perfectly elastic, meaning that for every percentage the price decreases, demand (or brand sales) increases by the same percentage; conversely, if the price increases by a certain percentage, sales will fall by the same percentage. Products with very dependent consumers, such as cigarettes, or products that do not have many substitutes, like fuel, have very low price elasticity, significantly lower than products and services where there are many substitutes, such as FMCG (fast moving consumer goods) products (Sharp, 2017). Situations that affect the increase in price elasticity include (Sharp, 2010, pp. 162-165):

- when the price reduction brings the brand closer to the reference price (the price that consumers perceive to be adequate for the benefit they get from the product or service),
- if the price reduction is promoted at the point of sale and becomes visible to a large number of customers. In those situations, reductions can lead to a significant increase in sales, especially if the reduction is substantial, for example, a 45% lower price than the regular can lead to an increase in sales from 280% to 400% (Totten & Block, 1997, p. 70),
- if it concerns a brand with a small market share, because brands with a larger market share and greater penetration have lower price elasticity. Here we observe the effect of the law of natural monopoly which

states: brands with a large market share have more customers who purchase infrequently, but who are the most loyal (Sharp, 2010; Romanik & Sharp, 2016). Thus, large brands have a monopoly over customers who buy rarely (light category buyers). This difference in elasticity tells us that small brands can achieve greater sales growth with price reductions, while on the other hand, if they increase prices, they experience a significantly larger drop in sales compared to large brands.

- when the price increases above the normal price. Research shows that the effect on sales is significantly greater when prices are raised (sales decline), compared to when a brand lowers its price (sales growth) - if we solely consider the effects of price changes and exclude price promotions (price highlighting) at the point of sale.
- in situations where the normal price is similar to that of the competition, then the price elasticity is significantly pronounced whether prices are raised or lowered.

### 2.3. Investment in Price vs. Investment in Advertising

When comparing investment in price, whether through long-term or temporary price reductions, with investment in advertising, it becomes evident that price promotions (temporary price reductions) have a greater effect on brand sales but have a very limited reach because they target only customers who are in the stores during that period. In contrast, advertising has a much wider reach as it targets a larger number of category customers but has a smaller effect on sales. However, price reductions motivate customers to buy more than they need, so every price promotion takes away from future purchases, i.e., future sales and profits. Besides the negative effect on profit, reducing the price, especially drastic reductions over 40%, lowers the reference price, thereby increasing the brand's price elasticity (Sharp, 2010). Promotional prices are like heroin for the brand; it's easy to start, hard to stop. Once brand customers get used to regularly buying on sale, it's very difficult to change that habit and continue building the brand on other bases. Strategies brands apply to avoid price reduction and price promotions include: improving perceived quality by customers, communicating quality through highlighting benefits compared to the competition, the company maintains the price so that investment in advertising allows it to achieve greater profit than lowering the price and lowering its profit margin; and raising quality and price, which can position a certain brand in a higher price range with higher profit margins (Kotler, Wong, Saunders, Armstrong, 2007). Based on the analysis of the IPA campaign database, it can be concluded that investment in price through various activities aimed at benefiting the customer in the form of lower prices affects price elasticity and lowers brand value in the long term. On the other hand, continuous investment in the brand in the long term reduces price elasticity and increases the intention to purchase by customers, without permanent and drastic price reductions, which have a greater effect on sales in the short term but adversely affect brand profitability in the long term (Binet & Field, 2010). According to Binet: "Long-term brand building is the key to firmer prices," there are three key elements for price growth without a drop in sales, i.e., for reducing the price elasticity of the brand (Binet, 2023):

- The first key element is reaching as many customers as possible, focusing on those who have not previously purchased the brand. Over 2000 case studies show the failure of companies that have strengthened their pricing power by targeting existing brand customers.
- The second crucial element is emotion. According to Binet, "The key to pricing power is to make people feel strongly about your brand, to bypass rationality and make people desire the product at any cost," so it is not possible to convince a customer to buy more with rational arguments.
- The third element is awareness, meaning campaigns aimed at making the brand known have a significant effect on reducing price elasticity and are very effective as support for raising the brand's price. The best way to achieve recognition and evoke emotion in customers is through creativity.

Based on the analyzed literature, the following questions emerge:

1. Is there a relationship between price promotions and the growth of customer numbers, or the expansion of penetration?
2. Do large brands, with a larger market share and greater penetration, have lower price elasticity?
3. Do small brands, with a small market share and low penetration, have higher elasticity, and can they achieve greater sales growth with price reductions?
4. Are customers who rarely purchase in the category (so-called light buyers) less price-sensitive, or is their proportion of purchases on discount lower compared to customers who frequently purchase in the category (so-called heavy buyers)?

## 3. MATERIALS AND METHODS

To achieve the stated objectives, the author employs "desk marketing research." Six books were read and results from four scientific papers dealing with this topic were thoroughly analyzed. To confirm the customer behavior patterns

identified through literature analysis, data from independent research conducted by GfK (household panel), a renowned marketing research company, were used. Secondary data obtained from the household panel helped to gain adequate insights and draw conclusions in line with the goals set for this work.

Consumer Panel Services GfK is a nationally representative sample of consumers whose shopping habits are reported and registered regularly over a period of time. Panel members provide an in-depth report about their purchases for household or individual needs via in-home scanning. Sample size is 2.000 households and represent 2.5 million households in Serbia.

In the research, brands within nine categories of consumer goods will be used, including their subcategories.

## 4. RESULTS

### Is there a relationship between price promotions and the growth in the number of customers, or the expansion of penetration?

Analyzing data from six categories with ten brands in each, on a monthly basis over a three-year period, involves examining brand penetration (the share of brand customers within all category customers), the value share of brand sales on promotion, and the quantity of brand sales during the observed period.

To analyze this vast amount of data, correlations between the following parameters were conducted: penetration and the share of promotional sales, and penetration and the quantity of brand sales in the observed year.

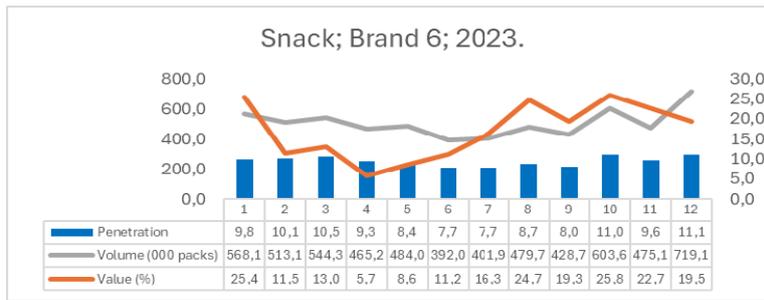
Name	2021		2022		2023	
	Penetration-Volume	Penetration-Value share	Penetration-Volume	Penetration-Value share	Penetration-Volume	Penetration-Value share
<b>FRANKFURTERS</b>						
Brand 1	0,84	-0,05	0,66	0,36	0,84	0,00
Brand 2	0,87	0,39	0,94	0,03	0,96	0,65
Brand 3	0,96	0,42	0,91	0,63	0,52	-0,38
Brand 4	0,87	0,20	0,82	0,16	0,91	0,25
Brand 5	0,81	0,30	0,89	0,26	0,89	0,00
Brand 6	0,69	0,38	0,87	0,41	0,78	-0,30
Brand 7	0,34	0,33	0,93	-0,47	0,91	0,11
Brand 8	0,80	-0,17	0,96	0,55	0,84	-0,19
Brand 9	0,93	0,47	0,88	0,37	0,78	0,19
Brand 10	0,72	0,51	0,84	-0,41	0,93	0,73
<b>GRILL SAUSAGES</b>						
Brand 1	0,95	0,11	0,94	0,63	0,95	0,09
Brand 2	0,92	0,21	0,97	-0,08	0,98	0,24
Brand 3	0,94	0,47	0,97	0,22	0,80	-0,04
Brand 4	0,96	0,71	0,92	0,33	0,84	0,27
Brand 5	0,84	0,45	0,97	-0,07	1,00	0,67
Brand 6	0,93	0,38	0,95	0,43	0,83	-0,64
Brand 7	0,99	0,20	0,80	0,40	0,94	0,25
Brand 8	0,97	0,36	0,96	0,25	0,71	-0,21
Brand 9	0,98	0,20	1,00	-0,67	1,00	0,50
Brand 10	0,89	0,33	0,93	-0,47	0,89	-0,39
<b>PATE</b>						
Brand 1	0,88	-0,26	0,88	0,44	0,89	0,82
Brand 2	0,62	0,56	0,51	-0,10	0,80	0,22
Brand 3	0,93	0,34	0,70	-0,01	0,92	0,41
Brand 4	0,72	0,27	0,93	0,36	0,79	0,05
Brand 5	0,91	0,18	0,90	-0,07	0,93	0,35
Brand 6	0,56	0,31	0,70	-0,30	0,72	-0,03
Brand 7	0,79	0,00	0,52	-0,07	0,96	0,45
Brand 8	0,59	0,29	0,71	0,19	0,65	-0,09
Brand 9	0,87	0,68	0,85	0,54	0,88	0,08
Brand 10	0,87	0,39	0,72	-0,01	0,57	0,41
<b>CHOCOLATE AND CHOCOLATE BARS</b>						
Brand 1	0,96	0,43	0,89	0,41	0,87	0,51
Brand 2	0,85	-0,37	0,90	-0,02	0,92	0,20
Brand 3	0,97	0,12	0,90	0,81	0,92	0,64
Brand 4	0,98	0,11	0,99	0,77	0,97	0,41
Brand 5	0,96	0,91	0,91	0,27	0,99	0,84
Brand 6	0,95	0,45	0,93	0,58	0,84	0,78
Brand 7	0,99	0,66	0,87	0,25	0,98	0,61
Brand 8	0,79	-0,22	0,96	-0,23	0,94	0,63
Brand 9	0,91	0,62	0,94	0,44	0,96	0,55
Brand 10	0,97	0,78	0,92	0,68	0,93	0,07
<b>COFFEE</b>						
Brand 1	0,77	0,90	0,70	0,12	0,39	-0,01
Brand 2	0,55	0,13	0,38	0,48	0,56	0,32
Brand 3	0,70	0,32	0,73	0,83	0,77	0,29
Brand 4	0,38	0,04	0,97	0,72	0,72	0,46
Brand 5	0,66	0,42	0,81	0,49	0,81	-0,18
Brand 6	0,57	0,65	0,53	-0,03	0,64	0,15
Brand 7	0,13	0,26	0,38	-0,40	0,96	0,74
Brand 8	0,73	0,46	0,44	0,27	0,61	0,47
Brand 9	0,75	0,81	0,89	0,31	0,73	0,22
Brand 10	0,77	0,40	0,95	0,64	0,84	-0,02
<b>SNACKS</b>						
Brand 1	0,66	0,30	0,94	0,47	0,94	0,48
Brand 2	0,79	0,29	0,79	0,78	0,88	0,34
Brand 3	0,87	0,54	0,45	0,13	0,91	0,11
Brand 4	0,91	0,20	0,77	0,42	0,86	0,10
Brand 5	0,87	0,36	0,96	0,19	0,86	0,57
Brand 6	0,88	-0,20	0,89	0,35	0,89	0,28
Brand 7	0,52	0,01	0,40	-0,22	0,75	0,15
Brand 8	0,85	0,21	0,66	0,39	0,89	0,07
Brand 9	0,87	-0,12	0,94	0,76	0,89	0,74
Brand 10	0,86	0,59	0,74	0,31	0,62	-0,34

**Table 1.** Correlation between penetration and the quantity of sales, and correlation between promotional sales and penetration.

In Table 1, the correlation values between promotional sales and penetration are very small for the majority of brands over all three years. On the other hand, there is a high correlation between penetration and the quantity of products sold, clearly indicating a relationship between the number of customers and the quantity of brand sales.

The data show that brands with high penetration (over 17%) have a slightly higher correlation between penetration and the share of promotional sales compared to brands with low penetration. Following this, there are charts with examples of several brands with high and low penetration. Blue histograms represent penetration, the gray line shows the trend of quantity sales, while the orange line indicates the value share of the brand's price promotional sales by months.





**Do large brands, with a larger market share or greater penetration, have lower price elasticity?**

Brand's price increases if average price 2023 > average price 2020		Volume (000 Litres)								Average Price (RSD/L/kal)								Price Elasticity			
Category (number of brands)	2020	market share		market share		market share		market share		2020	2021	2022	2023	2020	2021	2022	2023	2020	2021	2022	2023
		2020	2021	2022	2023	2020	2021	2022	2023												
TOOTH PASTE	Small brands decrease (1)	1	0%	1	0%	14,8	0,9%	21,2	1,4%	1,250	1,050	-19%	-4,24	1,73	-2,31						
	Small brands increase (6)	325,7	20%	318,6	19%	353,5	22%	287,8	19%	2,280	2,361	4%	2,190	-7%	2,694	23%	-0,82	-1,52	-0,81		
	Big brands increase (5)	1,222,8	73%	1,219,5	74%	1,135,7	71%	1,036,4	73%	1,380	1,377	1%	1,467	7%	1,703	16%	-0,22	-1,04	-0,27		
	PASTE	1,222,8	73%	1,219,5	74%	1,135,7	71%	1,036,4	73%	1,380	1,377	1%	1,467	7%	1,703	16%	-0,22	-1,04	-0,27		
GRILL SAUSAGES	Small brands decrease (1)	1	0%	1	1%	104,5	2%	135,7	2%	653	600	-12%	557	-2%	556	-5%	-3,84	-5,83	-2,25		
	Small brands increase (6)	4,501,1	73%	4,551,5	72%	4,285,0	69%	3,704,2	62%	718	754	5%	872	16%	1,004	15%	-1,31	-0,41	-0,38		
	Big brands increase (5)	2,572,2	25%	2,255,5	23%	2,172,4	24%	2,477,5	25%	438	473	8%	521	16%	554	16%	1,28	0,21	-0,35		
	ROASTED COFFEE	2,572,2	25%	2,255,5	23%	2,172,4	24%	2,477,5	25%	438	473	8%	521	16%	554	16%	1,28	0,21	-0,35		
CHOCOLATE	Small brands decrease (1)	1	0%	1	0%	1	0%	1	0%	1	0%	-10%	1	0%	1	0%	-1,54	-3,44	-1,34		
	Small brands increase (32)	4,287,2	33%	3,379,2	26%	3,773,6	35%	3,480,5	31%	575	536	-7%	773	13%	890	14%	-1,21	-0,21	-0,54		
	Big brands increase (14)	15,748,4	60%	15,267,9	61%	15,902,3	63%	14,175,3	58%	589	604	3%	657	9%	783	19%	-1,19	0,48	-0,35		
	SNACKS	15,748,4	60%	15,267,9	61%	15,902,3	63%	14,175,3	58%	589	604	3%	657	9%	783	19%	-1,19	0,48	-0,35		
CARBONATED SOFT DRINKS	Small brands decrease (5)	233,6	1%	248,1	1%	329,1	1%	335,0	1%	607	591	-3%	557	-4%	557	0%	-1,94	-8,50	1,11		
	Small brands increase (46)	7,604,2	29%	7,002,4	28%	8,038,2	24%	6,145,9	25%	527	580	6%	649	16%	716	10%	-1,28	-0,88	-0,13		
	Big brands increase (14)	15,748,4	60%	15,267,9	61%	15,902,3	63%	14,175,3	58%	589	604	3%	657	9%	783	19%	-1,19	0,48	-0,35		
	YOGHURT	15,748,4	60%	15,267,9	61%	15,902,3	63%	14,175,3	58%	589	604	3%	657	9%	783	19%	-1,19	0,48	-0,35		
YOGHURT	Small brands decrease (1)	1	0%	1	0%	1	0%	1	0%	1	0%	-10%	1	0%	1	0%	-1,54	-3,44	-1,34		
	Small brands increase (26)	49,357,4	32%	44,234,5	31%	34,015,9	27%	23,634,5	24%	127	129	2%	148	15%	148	15%	-1,28	-0,93	-0,87		
	Big brands increase (5)	32,307,4	62%	33,818,0	63%	33,503,2	66%	33,478,9	68%	129	129	0%	129	0%	129	0%	-1,28	-0,93	-0,87		
	YOGHURT	32,307,4	62%	33,818,0	63%	33,503,2	66%	33,478,9	68%	129	129	0%	129	0%	129	0%	-1,28	-0,93	-0,87		

**Table 2.** Differences in price elasticity depending on brand size.

Analyzing the data in the Tabel 2, we can conclude that out of 196 brands in 8 categories, the price elasticity of small brands is higher compared to large brands for 95% of the brands, meaning that raising or lowering prices for small brands reflects more significantly in sales decline or growth.

**Do small brands, with a small market share and low penetration, have higher elasticity, meaning can they achieve greater sales growth with price reductions?**

According to data in the Tabel 2, out of 8 brands that reduced prices, 6 brands (75%) achieved a significant increase in sales volume. Supporting this, the mentioned price elasticity, as well as specific examples in the following categories, tell us:

- For toothpaste, there is a similar number of small and large brands, but it's observed that small brands experienced a significant drop in quantities and market share, whereas large brands, despite significant price increases, maintained similar volume levels, and their volume market share remained the same (2020. compared to 2023.).
- A similar situation is observed in the categories of coffee, chocolate, soft drinks, and yogurt. Although there is a higher number of small brands raising prices, it is clear that they experience a decrease in quantities and market share, while large brands that have raised prices even see an increase in volume market share.
- Are customers who rarely purchase in the category (so-called light buyers) less price-sensitive, meaning is their proportion of purchases on discount lower compared to customers who frequently purchase in the category (so-called heavy buyers)?

**Are customers who rarely purchase in the category (so-called light buyers) less price-sensitive, meaning is their proportion of purchases on discount lower compared to customers who frequently purchase in the category (so-called heavy buyers)?**

	Value Share																			
	2020	2021	2022	2023	1. Quarterly 2020	2. Quarterly 2020	3. Quarterly 2020	4. Quarterly 2020	1. Quarterly 2021	2. Quarterly 2021	3. Quarterly 2021	4. Quarterly 2021	1. Quarterly 2022	2. Quarterly 2022	3. Quarterly 2022	4. Quarterly 2022				
<b>FRANKFURTERS</b>																				
FRANKFURTERS Light	25.1	27.9	26.3	29.1	28.6	21.5	28.5	23.6	33.4	31.4	28.8	23.9	30.5	27.7	28.8	32.4	33.5	35.2	29.5	25.1
FRANKFURTERS Medium	24.7	28.7	27.3	28.0	30.5	24.7	34.3	31.6	19.0	29.1	31.4	25.1	26.5	22.1	28.4	26.5	24.4	31.0	35.7	30.0
FRANKFURTERS Heavy	29.6	27.8	25.8	32.4	31.5	23.5	29.6	25.2	26.9	27.7	29.1	22.4	23.1	26.4	25.5	25.9	28.2	28.9	32.7	32.7
<b>PATE</b>																				
PATE Light	17.0	21.6	20.6	27.8	23.1	18.0	19.6	21.3	20.1	20.2	21.8	18.7	17.8	19.4	21.5	21.8	19.8	28.8	23.4	29.1
PATE Medium	17.0	21.4	23.3	27.7	19.6	10.9	19.7	23.0	25.0	16.6	23.9	23.9	23.6	25.7	23.6	24.6	23.0	26.7	29.4	25.9
PATE Heavy	24.1	24.9	28.4	33.2	28.0	19.2	25.2	25.9	22.4	29.6	23.2	27.6	23.4	24.3	25.3	26.1	29.3	39.3	34.4	35.2
<b>GRILL SAUSAGES</b>																				
GRILL SAUSAGES Light	25.4	26.9	28.7	36.9	37.0	23.9	22.3	27.8	31.9	38.4	33.9	33.0	31.3	34.5	40.3	40.1	35.4	34.6	40.9	42.7
GRILL SAUSAGES Medium	26.4	27.7	33.2	32.0	29.3	28.1	28.2	38.1	33.7	29.5	35.7	25.0	28.0	35.3	32.4	29.0	28.1	36.5	29.8	22.9
GRILL SAUSAGES Heavy	38.1	36.3	33.1	36.0	46.2	29.6	40.6	33.5	29.8	27.8	34.2	28.3	28.1	35.2	30.7	32.1	40.9	41.5	29.1	24.8
<b>ROASTED COFFEE</b>																				
ROASTED COFFEE Light	28.3	28.6	27.8	31.2	27.3	26.9	23.3	28.6	28.9	29.7	32.8	24.3	26.9	25.3	29.6	27.8	27.6	25.0	27.3	34.8
ROASTED COFFEE Medium	24.4	28.7	23.5	31.9	23.5	20.8	24.7	26.0	28.7	31.1	28.0	25.5	25.9	25.8	29.7	32.2	28.5	32.4	27.4	32.0
ROASTED COFFEE Heavy	24.8	25.1	29.1	36.3	26.0	24.4	25.1	27.5	26.3	26.4	28.0	24.1	26.8	31.7	31.0	32.3	31.6	33.8	38.9	36.3
<b>CHOCOLATE</b>																				
CHOCOLATE Light	21.6	28.1	25.7	32.8	25.1	29.8	26.6	27.7	28.0	31.5	30.0	27.3	26.2	27.2	31.6	26.0	29.4	29.2	32.0	31.7
CHOCOLATE Medium	30.9	29.4	31.7	32.7	33.0	27.3	24.8	32.3	24.9	33.1	30.2	30.2	27.8	30.6	30.9	35.0	28.7	34.7	33.3	33.6
CHOCOLATE Heavy	35.3	37.0	34.3	38.8	38.1	33.0	30.7	37.7	34.6	37.2	32.6	36.4	31.4	34.4	31.9	36.8	36.9	33.6	41.1	40.8
<b>SNACKS</b>																				
SNACKS Light	17.3	17.7	19.8	22.8	18.5	17.5	18.2	16.5	17.2	18.4	15.6	21.0	19.7	19.3	22.6	19.3	20.1	19.4	22.6	23.0
SNACKS Medium	18.8	19.9	19.8	21.4	17.6	16.0	19.6	18.2	19.8	19.2	23.8	17.7	19.2	21.5	19.0	20.8	21.0	21.5	24.7	21.5
SNACKS Heavy	18.6	22.1	24.1	24.9	16.2	16.7	20.5	22.0	20.3	22.4	21.2	21.2	21.8	23.8	23.1	24.0	22.5	22.8	26.5	25.0
<b>CARBONATED SOFT DRINKS</b>																				
CARBONATED SOFT DRINKS Light	16.6	17.5	12.9	16.4	17.2	17.7	18.0	17.9	16.6	18.7	17.4	18.6	16.3	14.4	10.6	13.9	12.4	16.5	15.9	15.0
CARBONATED SOFT DRINKS Medium	18.4	20.5	14.8	18.8	15.1	15.2	19.4	22.9	19.6	20.9	15.3	22.8	18.2	15.1	9.5	12.8	15.7	17.5	15.2	20.0
CARBONATED SOFT DRINKS Heavy	19.5	22.0	15.1	21.0	15.8	16.5	21.5	25.9	24.3	20.7	19.4	21.5	19.3	15.9	11.5	15.3	15.4	23.7	20.3	24.9
<b>YOGHURT</b>																				
YOGHURT Light	19.9	17.6	18.8	26.0	15.7	18.5	20.1	21.7	23.4	20.4	20.9	20.2	20.3	17.7	20.0	21.1	25.0	22.1	24.1	23.9
YOGHURT Medium	24.0	26.3	23.3	29.5	25.9	19.7	22.7	24.9	24.6	28.4	25.3	24.5	22.6	26.6	22.3	23.4	27.0	30.3	31.0	30.8
YOGHURT Heavy	27.1	29.5	28.7	35.1	27.4	26.0	29.1	28.1	27.6	29.9	28.9	28.7	26.2	25.9	27.2	30.3	33.2	36.0	33.4	34.6
<b>TOOTH PASTE</b>																				
TOOTH PASTE Light	34.0	26.4	27.8	27.7	25.0	28.7	37.7	30.1	32.5	25.7	31.7	26.1	27.9	28.3	20.8	27.9	25.4	26.8	27.4	31.1
TOOTH PASTE Medium	32.4	31.3	31.5	34.8	31.2	27.0	38.3	37.4	34.4	34.5	32.6	33.9	31.0	31.1	27.5	34.0	31.6	29.7	34.8	29.5
TOOTH PASTE Heavy	34.6	34.6	34.1	33.7	33.1	34.4	36.3	35.2	35.3	34.7	32.0	33.0	32.3	36.9	34.3	36.3	37.5	30.0	34.3	35.2

**Table 3.** Differences in the share of promotional purchases depending on customer type.

In Table 3, we have data for nine product categories, for a period of four years, as well as data for each quarter from 2020. to 2023. For each of these periods, we have data on the share of price promotional purchase, which are provided within the categories for three types of customers: "light" - customers who rarely use the category, "medium" - customers who use the category occasionally, and "heavy" - customers who frequently use the category. Based on the data analysis, the conclusion arises that for most categories and in the majority of the observed periods, there is a higher share of price promotional purchase among customers who frequently use the category compared to customers who rarely use the category.

## 5. DISCUSSION AND CONCLUSION

Based on the theoretical framework presented in the relevant literature, further confirmed by the analysis of secondary data obtained from household panels, it can be concluded that there is a relationship between price and other parameters significant for brand growth.

Firstly, the analyzed data suggest a weaker relationship between temporary price reductions and an increase in penetration. Instead, the correlation between penetration and sales volumes is higher. This phenomenon aligns with Sharp's assertion: „temporary price reductions do not attract new customers“ (Sharp, 2010) and suggests the temporary nature of price promotions' effectiveness in sustainable brand growth.

Secondly, the research highlights a distinct variance in price elasticity between large and small brands. Large brands, with their established market presence and higher penetration, exhibit lower price elasticity. This means that their sales are less affected by price changes, whether increases or decreases. In contrast, small brands, characterized by lower market shares and penetration, demonstrate higher price elasticity. Consequently, large brands may, in some circumstances, better capitalize on their brand value through price increases, thus enhancing profitability. In this regard, price elasticity can serve as one of the indicators for measuring the effectiveness of brand investments

Lastly, the effectiveness of price promotions is further nuanced by the segment of buyers. Light buyers, who purchase infrequently within the category, are less responsive to price discounts compared to heavy buyers. In addition to the recommendation of Sharp that light buyers are key to the growth of the brand because there are the most of them (Sharp, 2010), the conclusion that they are less price sensitive further confirms the importance of this segment, which can also affect the growth of the brand's profitability.

In conclusion, while price promotions can serve as a tactical tool for short-term sales boosts, their impact on long-term brand growth is limited. For sustainable brand growth, a balanced strategy that combines price optimization with investments in brand building and customer acquisition is essential. Companies must strike a balance between leveraging price as a competitive tool and investing in the brand.

Future research should aim to elucidate the nature of the relationships between price and other brand-related parameters. According to the authors, it is important to develop an adequate methodology that will demonstrate the significance of each of the key parameters (penetration, price elasticity, mental availability parameters, loyalty) on brand growth.

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### **Nenad Djokic**

University of Novi Sad, Faculty of Economics  
 in Subotica  
 Subotica, Serbia  
 nenad.djokic@ef.uns.ac.rs

### **Nikola Milicevic**

University of Novi Sad, Faculty of Economics  
 in Subotica  
 Subotica, Serbia  
 nikola.milicevic@ef.uns.ac.rs

### **Ines Djokic**

University of Novi Sad, Faculty of Economics  
 in Subotica  
 Subotica, Serbia  
 ines.djokic@ef.uns.ac.rs

## **MEDIA MIX BUDGET ALLOCATION**

**Abstract:** An important topic within marketing communications management is related to media mix budget allocation. In addition to traditional approaches, the new circumstances in which there is the use of digital marketing and the availability of a significantly greater volume of data yielded new possibilities in approaching the topic. Furthermore, one should not neglect the privacy regulations affecting future data availability. In all those considerations, the emphasis on different media effectiveness and its measurement is crucial. In this paper, the authors present different approaches to media mix budget allocation. The secondary research is performed by analyzing scientific papers related to the topic.

**Keywords:** Marketing communications, Media mix, Media effectiveness; Budget allocation

### **1. INTRODUCTION**

As Belch and Belch (2021) suggest planning is essential for creating and executing a successful integrated marketing communications (IMC) program. The process is guided by an integrated marketing communications plan, which serves as the framework for developing, implementing, and managing the organization's IMC efforts. Hereby, when reviewing the IMC plan, it can be concluded that it consists of (Belch & Belch, 2021, p. 33):

- Promotional program situation analysis
- Analysis of communication process
- Budget determination
- Development of IMC program
- Integration and implementation of MC strategies
- Monitoring, evaluation and control of IMC program

In addition, mentioned authors present that, when considering budget determination, there are two topics that should be in a focus: setting tentative MC budget and allocating tentative budget.

When it comes to the topic of setting the budget, just as an illustration of the complexity of the issue, Danenberg, Kennedy, Beal and Sharp (2015) can be cited when suggesting that in the case of advertising, there are several available methods to assist with budgeting, such as marginal analysis, elasticities, econometric modeling, and game theory approaches. They also add that despite these advanced techniques, the use of heuristics remains common and can be advantageous for accurate forecasts. Hereby, one prevalent heuristic is setting the advertising budget as a fixed percentage of sales.

Similar complexities can be identified in regard to budget allocation. Hereby, again as in illustration, Saboo, Kumar and Park (2016) can be cited. These authors stress that marketing resource allocation has become increasingly important as managers face greater pressure to achieve results with limited budgets. As firms constrain their marketing spending, marketers are challenged to optimize the effectiveness of their marketing investments. They also point out that scholars have contributed extensively to this area of study, offering both methodological and substantive insights into the complex decisions involved in marketing resource allocation. The overarching theme of such research is to evaluate how marketing actions influence consumer demand and subsequently adjust resource allocation across various

dimensions such as media, channels, geographic regions, product lines, customer segments, and more, with the goal of enhancing firm value. The literature in this field emphasizes the need to understand the impact of different marketing strategies and tactics on consumer behavior and business outcomes to inform more strategic and efficient allocation of marketing resources. In the realm of marketing resource allocation, scholars have proposed various transactional, shopping, attitudinal, and organizational characteristics to explain differences in consumer purchasing behavior. These characteristics include factors like recency, frequency, and monetary value of transactions, shopping behaviors such as return behavior or use of multiple channels, and attitudinal factors like satisfaction and loyalty. Additionally, organizational marketing efforts are considered in understanding consumer purchase patterns. Using these insights, scholars have explored how marketing resources should be distributed across different customer segments and marketing activities, such as customer acquisition versus retention, advertising versus sales efforts, or value creation versus appropriation. They have also considered market or geographic allocations. Many of these tools and methodologies developed by scholars have been made accessible to managers to assist them in making informed resource allocation decisions. Despite these advances, the research indicates that companies often continue to allocate resources based on historical patterns and rules of thumb rather than adapting their allocations strategically based on current marketplace dynamics. This discrepancy highlights a gap between theoretical understanding and practical implementation in marketing resource allocation, where strategic reallocation based on market considerations is recognized as delivering superior returns but is not consistently applied in practice. Addressing this gap could lead to more effective resource allocation strategies and improved business outcomes for firms.

In the light of previous considerations, the paper is divided in two parts. First parts deal with promotional budgeting in general describing traditional approaches still widely used. The second part of the paper is devoted to two innovative approaches used for media budget allocation – namely, attribution and marketing mix modelling.

## **2. TRADITIONAL APPROACHES OF DETERMINING PROMOTIONAL BUDGETS**

There are two categories that can be identified within the traditional promotional budgeting approaches – top-down and bottom-up - and individual methods belonging to them will be presented in this section according to Belch and Belch (2021, pp. 237-248). In the top-down approach, a predetermined budget is established, usually at an executive level, and then distributed among various departments within the organization. These allocations lack a solid theoretical foundation and are often based on subjective judgments. Furthermore, a significant limitation is their tendency to disconnect budgetary allocations from specific objectives and corresponding strategies. Methods within the top-down category include the affordable method, arbitrary allocation, percentage of sales, competitive parity, and return on investment (ROI). In contrast, a more effective approach involves aligning the firm's communication objectives with the allocated budget, and belongs to build-up methodologies. One such method is the Objective and Task Method, which emphasizes determining communication objectives and the allocation of resources accordingly.

The Affordable Method considers the firm determining the allocation of funds across different areas such as production and operations, with the remaining sum is allowed for advertising and promotion, based on what is assessed affordable. However, this method neglects to consider the specific tasks to be undertaken by the advertising/promotions function, which can result in the likelihood of both under- and overspending, given the absence of established guidelines for assessing the impact of various budget allocations. While characteristic of small firms, it is also employed by larger enterprises, particularly those not driven by marketing and lacking comprehension of the significance of advertising and promotion. Moreover, during challenging market conditions characterized by declining sales or profits, this method may lead to budget reductions, contrary to the necessity of increased investment in such circumstances.

Arbitrary Allocation represents a weaker approach compared to the Affordable Method for budget establishment, as it lacks a substantial theoretical foundation, often relying solely on management's subjective judgment to determine the budgetary amount. This method offers no advantages, as it lacks systematic planning, objective setting, and consideration of the fundamental concepts and objectives of advertising and promotion. Despite its deficiencies, this approach persists, typically driven by a managerial belief that some expenditure on advertising and promotion is necessary, without a clear rationale for the chosen budgetary figure.

The Percentage of Sales method is widely used for budgetary allocation, especially in large firms, where the advertising and promotions budget is tied to product sales. Management determines this budget either by applying a percentage to sales revenue or by allocating a fixed amount of the unit product cost to promotion and then multiplying it by the number of units sold. Alternatively, a variant of this method relies on a percentage of projected future sales as the basis. This approach offers an advantage over basing the budget solely on past sales, as it requires forecasting future sales, thereby incorporating market dynamics into the budgeting process. Advocates of the Percentage of Sales method highlight its financial logic, as it maintains advertising expenditure within reasonable bounds, ensuring adequate funds to cover the budget while allowing for adjustments in response to sales fluctuations. Moreover, it is straightforward to implement and provides stability, enabling managers to anticipate budgetary parameters. However, several disadvantages undermine its efficacy. First, it establishes an opposite causal relationship between advertising and sales, also treating advertising as an expense rather than an investment. Additionally, it lacks flexibility regarding changes in strategy, preventing firms from allocating additional funds for aggressive marketing approaches. Moreover, it may lead

to misallocation of funds, with products experiencing low sales potentially receiving inadequate promotional budgets, while successful products may have excess funds. The method also poses challenges for new product introductions, particularly in the absence of sales data for forecasting. Furthermore, it complicates the issue during periods of declining sales, as budget cuts prevent efforts to reverse the downward trend. Although the Percentage of Future Sales method has been proposed as a solution, challenges in forecasting and uncontrollable market factors limit its effectiveness.

The Competitive Parity method leverages insights into competitors' advertising expenditures, which are often obtained from competitive advertising information providers, trade associations, and industry periodicals. Larger corporations may subscribe to services like Competitive Media Reporting, which tracks advertising expenditures across various media for the top 1,000 companies. On the other hand, smaller firms may employ clipping services to gather competitors' ads from local print media, facilitating the estimation of cumulative advertising costs. Managers utilizing the competitive parity approach establish budget amounts by aligning with competitors' percentage-of-sales expenditures, under the premise that this practice taps into industry wisdom and promotes market stability by discouraging aggressive marketing tactics. This method assumes that competitors' spending patterns reflect effective marketing strategies and aims to minimize marketing conflicts. Despite its perceived benefits, the competitive parity method has notable drawbacks. Firstly, it overlooks the specific objectives that advertising and promotions are intended to achieve, as well as the individual problems and opportunities they address. Secondly, it presupposes that similar expenditure levels equate to equal effectiveness, disregarding the impact of creative executions, media allocations, and product quality variations among firms. Moreover, it fails to anticipate changes in competitors' strategies or market dynamics, potentially leading to competitive disadvantages. Additionally, there is no guarantee that competitors will maintain consistent spending patterns, rendering the method susceptible to unforeseen shifts in promotional activities. In practice, few firms rely solely on the competitive parity method for budget allocation. Instead, it is often employed in conjunction with other approaches such as the percentage-of-sales method.

The Return on Investment (ROI) budgeting method views advertising and promotions as investments, with budgetary allocations considered as investments that yield returns. Similar to other facets of the firm's activities, advertising and promotion are anticipated to generate a specific return. Despite receiving considerable attention from practitioners in recent years, there remains disagreement regarding the appropriate measurement of ROI. While the ROI method appears promising in theory, in practice, assessing the returns generated by promotional efforts is often challenging, particularly when sales remain the primary metric for evaluation. Consequently, although managers invariably seek to ascertain the returns on such expenditures, determining the precise return remains elusive and contingent upon the criteria utilized to gauge effectiveness.

The Objective and Task Method relies on the relationship between objective setting and budgeting, emphasizing that these processes should be simultaneous rather than approached sequentially. Establishing a budget without clear objectives is challenging, just as setting objectives without considering available financial resources lacks coherence. This method employs a buildup approach comprising three steps: delineating the communication objectives to be achieved, identifying the specific strategies and tasks necessary to accomplish these objectives, and estimating the costs associated with executing these strategies and tasks. The total budget is then determined by aggregating these costs. A significant advantage of the Objective and Task Method is its alignment of the budget with the objectives to be achieved. However, a notable drawback lies in the difficulty of determining the requisite tasks and their associated costs. This challenge is diminished when past experience can serve as a reference, either with the existing product or a comparable one in the same product category. Nonetheless, it remains particularly challenging for new product introductions. Consequently, budget setting using this method is comparatively more complex and less stable than some of the previously discussed approaches.

### **3. ATTRIBUTION**

A detailed description of attribution is provided by Schultz and Dellnitz (2018) and the first part of this section is based on their explanation. Namely, they first stress that customers engage with brands through various touchpoints across different channels and media platforms, establishing multiple interactions before making online purchases. These interactions, occurring through diverse channels, influence subsequent customer-brand engagements. The sequence of these touchpoints constitutes what is commonly termed as the "customer journey". The proliferation of marketing tools presents a challenge for advertisers in discerning the individual impact of each instrument and strategizing its future utilization. Advertisers seek insights into the contribution and efficacy of each marketing instrument towards specific advertising objectives. The digital landscape provides ample tracking data on online consumer behavior, enabling advertisers to track individual customer journeys. Consequently, online advertising analysis primarily operates at the individual user level, as opposed to traditional aggregate-level performance analysis.

In order to comprehend the influence of various touchpoints on predefined outcomes, advertisers employ attribution, a process of assigning value to each touchpoint. Attribution models offer a framework for distributing contribution values across multiple touchpoints within a customer journey. Thus, attribution modeling significantly impacts the assessment of marketing channels used. These models facilitate the understanding of customer behavior, the interplay between marketing channels, enhance budget allocation, and ensure marketing accountability. Generally, attribution models

refute the notion that only the first or last touchpoints are solely responsible for customer journey outcomes; instead, intermediate touchpoints also play significant roles.

Schultz and Delnitz (2018) also add that attribution models can be broadly categorized into heuristic and analytical types. Heuristic attribution models employ simple rule-based approaches, such as first touch, last touch, linear (equally weighted), time decay, and u-shaped (position-based) attribution. In contrast, analytical attribution models utilize data-driven methodologies like logistic regression, time series analysis, and Markov chains.

The primary aim of attribution models is to enable advertisers to allocate marketing budgets based on the impact of marketing channels on customer journey outcomes. However, if consumer behavior is more intricate than assumed by heuristic models, there's a risk of misallocating marketing budgets.

To these considerations should be added the research of Danaher and van Heerde (2018). The focus of the discussion revolves around the appropriateness of using attribution for media allocation decisions, with the conclusion being that attribution is not suitable for this purpose. The authors argue that although attribution and profit-maximizing allocation of a fixed budget may appear similar, they represent fundamentally different concepts. Attribution entails providing a descriptive summary of each medium's relative contribution to a purchase, whereas profit-maximizing allocation involves determining the optimal weight for each medium to maximize profit. To conduct a thorough comparison between attribution and profit-maximizing allocation, the authors suggest formalizing both concepts. While the marketing literature typically relies on formal optimality principles for allocation decisions, the concept of attribution lacks a formal definition within this literature, leading to ambiguity. To address this gap, the authors propose a new, formal expression for calculating attribution based on each medium's incremental contribution to purchase probability. This mathematical formulation aims to clarify and refine the concept of attribution, enabling a deeper understanding of its relationship with allocation approaches in media planning and budget optimization. Ultimately, this formalization enhances precision and aids in distinguishing the similarities and differences between attribution and allocation strategies in marketing decision-making.

## 4. MARKETING MIX MODELLING

The term marketing mix modelling is often used interchangeably with media mix modelling. Although their scope is different, they deal with rather similar topics. The explanation of that topic is based on Jin, Wang, Sun, Chan and Koehler (2017).

Media mix models (MMM) are tools used to analyze how media spending impacts sales and to optimize the distribution of spending across different media channels for maximum effectiveness. Typically, these models work with aggregated data on a weekly or monthly basis, covering national or regional levels. The data they use encompasses various elements like sales figures, pricing, product distribution, media expenditure across different channels, and external factors such as economic conditions, weather, seasonal trends, and competitive dynamics. These models often rely on regression analysis to establish causal relationships from observed correlations. Conducting randomized experiments to gather such data is often impractical and costly when dealing with multiple media channels at scale. In the context of decision-making within these models, sales response to media variables is typically assumed to be linear. However, this linear model has limitations, particularly in accounting for ad saturation and diminishing returns as media spending increases — a phenomenon referred to as the shape effect. Moreover, the models usually only capture the immediate impact of advertising, focusing on the change in sales during the period when the advertisement is running. However, it's widely recognized that advertising also has a delayed impact or carryover effect, where its influence extends beyond the immediate exposure period. This delayed effect can be due to consumers taking time to respond to the ad, delaying purchases based on inventory levels, or making purchases influenced by interactions with others who saw the advertisement earlier.

In their paper, Chan and Perry (2017) delve into the challenges that compromise the reliability of Marketing Mix Models (MMMs) when applied to observational data, issues which are commonly faced by modelers but often overlooked in discussions with end-users. They identify three primary areas of concern: data limitations, selection bias, and modeling complexities.

Firstly, data limitations pose a substantial obstacle. This includes issues such as a scarcity of data, correlated input variables, and a restricted range of data. Limited data availability and diversity can hinder the accurate estimation of model parameters and relationships.

Secondly, selection bias emerges as a critical issue affecting the validity of MMM estimates. This bias occurs when a media input variable is associated with an unobservable demand driver that influences sales. If this influential variable is not included in the regression analysis, the model struggles to attribute sales accurately between media channels and underlying demand factors.

To address these challenges, the authors advocate for improvements in both data quality and modeling techniques. They highlight the potential impact of adopting better models to enhance MMM reliability.

One proposed modeling approach is the Bayesian method. The benefits of Bayesian modeling include the ability to incorporate informative priors derived from various sources, handle complex models effectively, report on parameter and model uncertainties comprehensively, and propagate uncertainty in optimization statements.

Additionally, the paper discusses category models as a means to introduce more data and variability into MMMs. By pooling data from multiple brands within the same product category, the model can leverage more independent variability, assuming that different brands operate with distinct advertising strategies and execution.

Another strategy involves using sub-national data (geomodels), which allows for more granular analysis at the city, county, province, or state level. This approach can reduce model uncertainty and enable more effective parameter estimation and budget optimization.

The authors emphasize the importance of control variables, particularly in mitigating selection bias. For instance, in estimating Return on Advertising Spend (ROAS) for paid search advertising, incorporating search volumes for relevant queries as a control variable can help address underlying demand factors.

To capture complex conditional dependencies, especially related to media effects, the authors suggest employing graphical models. These models can express dependencies between observed and unobserved variables, providing a more realistic framework compared to traditional regression approaches.

Finally, the paper underscores the value of simulation studies to evaluate model performance under different scenarios. By using simulators to generate datasets that mimic real-world conditions, modelers can test and refine MMMs under various assumptions and assess their robustness across different marketing environments.

## 5. DISCUSSION AND CONCLUSIONS

The paper discusses the significance of media mix budget allocation as well as determining promotional budget in marketing communications management. It presents traditional approaches in promotional budget allocation first. It also highlights the impact of digital marketing and the vast amount of data now available, which has opened up new possibilities for budget allocation strategies. Hereby, the special emphasis is on attribution and marketing mix modelling. These insights arise from secondary research conducted through the analysis of scientific papers on the topic.

The knowledge regarding described topics can be of special importance not only in academic society but in the applied field as well. Future researches could provide more detailed explanations regarding each of individual topics discussed within this paper.

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# **Session**

# **5**



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### **Vuk Vuković**

University of Novi Sad, Faculty of Economics  
 in Subotica  
 Subotica, Serbia  
 vuk.vukovic@ef.uns.ac.rs

### **Lazar Raković**

University of Novi Sad, Faculty of Economics  
 in Subotica  
 Subotica, Serbia

lazar.rakovic@ef.uns.ac.rs

### **Nebojša Gagić**

University of Novi Sad, Faculty of Economics  
 in Subotica  
 Subotica, Serbia  
 nebojsa.gagic.g012022@student.ef.uns.ac.rs

### **Slobodan Marić**

University of Novi Sad, Faculty of Economics  
 in Subotica  
 Subotica, Serbia

slobodan.marić@ef.uns.ac.rs

### **Nebojša Taušan**

University of Novi Sad, Faculty of Economics  
 in Subotica  
 Subotica, Serbia  
 nebojsa.tausan@ef.uns.ac.rs

## **BARRIERS IN THE IMPLEMENTATION AND ADOPTION OF CLOUD ERP SYSTEMS**

**Abstract:** For the digitization and integration of internal business processes and data, organizations have been relying on the use of ERP systems for decades. They have evolved from their predecessors MRP, MRP II, on-premise ERP 1.0 from the 1990s to ERP 1.0+ from the 2000s and now into ERP 2.0 systems based on cloud computing technology. Today, cloud ERP systems represent the dominant type of information systems on which organizations base their business, making it essential to comprehensively consider all the benefits they offer. On the other hand, it is realistic to expect certain complications that arise during the crucial phases in the lifecycle of cloud ERP systems, namely, the implementation and adoption phases. The aim of this paper is to review relevant scientific works and highlight the obstacles that burden the implementation and adoption of cloud ERP systems. The outcome of this study, in the form of identified and described barriers of cloud ERP systems, can be beneficial to various levels of management during the implementation and adoption of cloud ERP systems.

**Keywords:** Cloud ERP, barriers, implementation, adoption

## **1. INTRODUCTION**

In the fast-evolving landscape of digitalization and streamlined business operations, Enterprise Resource Planning (ERP) systems have played a pivotal role for decades. From their early manifestation as Material Requirements Planning (MRP) and MRP II systems to the emergence of on-premise ERP 1.0 in the 1990s and the subsequent ERP 1.0+ systems in the 2000s, ERP solutions have continuously adapted to meet organizational needs. However, the latest evolution brings us to ERP 2.0, a breed of systems powered by cloud computing technology. It is noticeable that transition to cloud oriented ERP solutions catches up speed as there are more solutions in the market by each new day we witness. "In the age of digital transformation, Cloud ERP systems have emerged as the linchpin of modern organizational architecture, seamlessly integrating processes and data across diverse sectors." (Drucker, 2016, p. 115) Cloud ERP systems have emerged as the primary foundation of organizational information infrastructure. Among others - their flexibility, scalability, and accessibility make them indispensable for businesses across various industries and sectors. As organizations increasingly rely on these cloud-based solutions, it becomes imperative to explore their multifaceted benefits comprehensively. Yet, alongside the promise of efficiency and agility, realistic barriers emerge during critical phases in the lifecycle of cloud ERP systems: implementation and adoption. These phases are pivotal, shaping the system's effectiveness and long-term impact. Organizations must navigate these complexities with care, considering both the advantages and potential obstacles. "Organizations must embark on a journey of careful navigation

through the complexities of implementation and adoption, recognizing these phases as instrumental in determining the success and sustainability of cloud ERP utilization." (Smith & Johnson, 2020, p. 201).

Marsintauli and Sari (2023) show us the importance of focusing on behavioral factor alongside technical premises by highlighting that expected performance has a positive impact on behavioral intentions. In contrast, variable expected effort, social influence, and facilitating conditions do not significantly influence behavioral intentions. Furthermore, behavioral intentions have a positive effect on usage behavior, reflecting an individual's belief that utilizing an information system will enhance their work performance. People's behavior can be observed through their intention to use an information system. If someone believes that the system aids in completing their tasks, they are more likely to use it. However, the study results reveal a discrepancy between users' belief in the system's helpfulness for task completion and their assessment of the expected lifespan of effort.

Venkatraman and Fahd (2016) emphasize that in the small and medium-sized enterprise (SME) sector, the myth persists that ERP (Enterprise Resource Planning) systems are intelligent solutions that can address all organizational business problems, such as customer satisfaction, product productivity, and manufacturing efficiency. However, the reality is that an ERP system must be tailored to meet specific business requirements and be managed by the organization's personnel, who make critical business decisions. Consequently, successful ERP adoption not only requires active involvement from ERP vendors but also full support and engagement from top SME management.

Most commonly, SMEs expect ERP solutions to be cost-effective, providing substantial benefits without significant investment. While ERP vendors strive to optimize Total Cost of Ownership (TCO), the quality of implementation and delivery remains proportional to the level of investment. In the case of Application Service Provider (ASP) solutions, both small and large enterprises often fail to realize the TCO benefits promised by ERP vendors due to limited investments. Additionally, many SMEs exhibit reluctance to upgrade their existing IT infrastructure.

Within this paper, authors explore relevant scientific literature, aiming to uncover the barriers that disrupt successful implementation and adoption of cloud ERP systems. By identifying and describing these barriers, authors provide valuable insights for management at various levels. Authors findings serve as a compass, guiding organizations toward informed decisions and sustainable ERP utilization. The authors emphasize that this research is part of a broader effort to explore the barriers in the cloud ERP life cycle, which will occur in the future.

## **2. RESEARCH METHOD**

This paper used a literature review as a research method. It was performed by searching the Google Scholar database of publications to collect qualitative data that represent barriers of cloud ERP implementation and adoption. The terms "barriers" AND "cloud ERP implementation and adoption" were used as search keywords. The meta data (title, keywords and abstract) of the scientific papers that appeared in the search results were first analysed. The analysis was conducted based on the inclusion and exclusion criteria that had been previously defined. To be considered for inclusion in the detailed analysis, papers were required to be written in English, published in scientific journals and conference proceedings, and to be thematically related to the research goal. The detailed analysis excluded papers representing master's theses and doctoral dissertations, papers that did not pass the review process, and papers that were not available. The papers that met the inclusion criteria were then subjected to further analysis to arrive at the results of this theoretical research.

## **3. FINDINGS**

This section presents the results of the conducted literature review, focusing on the overview and description of the characteristics and specificities of barriers in the implementation and adoption of cloud ERP systems.

Cloud ERP systems are complex standard packages of applications that cover multiple areas and can be customized to meet the needs of different users, with high requirements for integrating with existing systems. The profound impact of ERP systems on organizations makes their implementation challenging. Globally, ERP systems represent a significant part of the software industry, and providers are now offering cloud-based ERP systems. With an increasing number of vendors entering the market, the ERP system market is worth billions of dollars. Cloud ERP has a profound impact on an organization because it changes what is purchased, how and from whom purchase is performed. In addition to reducing initial investment and implementation costs, it can also limit the ability to customize and integrate software according to the needs of individual users. A cloud ERP system applies a service-oriented concept, where users consume services delivered via the Internet by service providers. This differs from the traditional product-oriented ERP business model (Gupta et. al., 2017).

Mahmood, Khan and Bokhari (2020) identified a lower-than-expected level of adoption and insufficient understanding of key success factors and barriers to successful adoption as challenges to the adoption of cloud-based solutions. In addition to the previous two, they identified some other barriers, but the line between implementation and adoption barriers is not as clear as it could be, so implementation barriers are frequently used as materials for adoption barriers in the literature. One of those barriers is a mismatch between business processes and the logic of the cloud ERP system that can make its implementation difficult. The importance of managerial support and an effective change management plan can be key barriers. Lack of user training and lack of assigned resources as well as excessive application

customization can prevent successful implementation. ERP systems in the cloud can be rigid, while excessive customization can result in failed implementations, especially if organizations are not ready for change.

Haddara, Gøthesen and Langseth (2021) categorize the barriers into implementation and adoption barriers. The uncertainty of configurations and customizations is connected to the implementation phase, since it concerns technical aspects like system setup before the system is active in the operational environment. Adaptability of services to specific operations and industries (adaptability of the ERP landscape) describes how an organization adopts and adapts ERP services into its existing business processes and presents the challenge of adopting cloud ERP. Demand volatility is a challenge that applies to both phases. The volatility of demands may however negatively affect the adoption phase, when continuously changing requirements can make it difficult for the organization to adapt to new services. A challenge that is related to the implementation phase is the need for expert assessments to ensure the ERP service meets the needs of the organization. However, it can also arise during adoption, when expertise is needed.

Huang, Anwar, Oliver and Rahim (2022) and Gupta et al. (2017) identified barriers specific to the implementation of cloud ERP systems in companies: cloud transparency and data privacy, data security, vendor lock-in, integration with other information system applications and typical organizational barriers.

Cloud computing has the characteristic of separating enterprise data from user company hardware and servers, which means IT operations run by third-party cloud providers are not transparent to user companies, who also have limited control over the cloud services they subscribe to. Cloud environments have a lack of transparency and control that can raise concerns about data privacy. Some businesses worry about where their business data will be physically stored by cloud service providers and whether their sensitive data will be protected. In the cloud ERP model, data access and security policies are becoming increasingly important, as is the cost of protecting data privacy, which can be high for small and medium-sized enterprises. In addition, client companies have little control over how cloud service providers store and process their data. The data privacy issue is one of the reasons why many organizations hesitate to implement cloud ERP systems.

Cloud service providers are believed to provide more secure IT infrastructure for protecting data. The most common cause of data leak and data loss, however, is often human error rather than technical failures. By definition, cloud ERP systems integrate different business processes of the organization, as well as different departments. The aforementioned integration provides managers with access to data from other business units. In case managers make copies of data on their own devices that are subject to theft or loss, the data on those devices would also fall into unauthorized hands. Data security, confidentiality and ownership represent some of the biggest barriers for cloud ERP (Hustad, Sørheller, Jørgensen, & Vassilakopoulou, 2020). Many organizations believe that their data can only be protected if it is kept within the organization itself. As a result, they are concerned data could be stolen or leaked during the implementation if data are in the cloud. Considering that data security is in the hands of the cloud ERP provider, there is no guarantee of absolute security.

Vendor lock-in occurs when a customer is not able to switch cloud providers due to dissatisfaction with the provider without significant costs, legal constraints or technical incompatibility. A company can maximize the strategic advantages of cloud technology in two ways. The first way is by changing cloud service providers according to their ever-changing business strategies. The other option is to merge various cloud services/solutions to create own system of the highest quality. Client companies need to provide data in a format that can be used by other cloud ERP providers (Haddara, Gøthesen, & Langseth, 2021).

Integrating cloud ERP systems with other information system applications is also a challenge, as managing this process will be even more challenging in a cloud environment. Specifically, client companies with limited control over the cloud will not have the freedom and rights to customize cloud ERP and integrate it with other applications as they would with on-premise ERP systems. Cloud ERP system providers may not be able to integrate company's information system software applications because they are developed using different technologies and platforms (Muslmani, Kazakzeh, Ayoubi, & Aljawarneh, 2018).

The previous research suggests that typical organizational problems like poor top management support, poor cross-functional communication, ineffective reengineering of business processes, and ineffective change management processes will always occur rather than technical problems (Øverdal, Haddara, & Langseth, 2023).

According to Øverdal, Haddara, and Langseth (2023), cloud ERP systems face barriers such as change management and increasing efficiency of use. Specifically, user education, learning how to use, discovering, understanding, and implementing all existing features and functions of the product have been identified as key barriers post-implementation. Client companies will face these barriers if they are not able to trust the cloud ERP provider and if the provider is not approachable and helpful. Cloud ERP providers should provide such a guarantee and be involved with the entire process, from planning to production. It is important that cloud ERP vendor representatives (consultants) and senior managers in client companies be trained on change management techniques.

Usman et al. (2017) note that finding suitable software solutions is the main challenge facing small and medium-sized enterprises (SMEs). In contrast to large enterprises, cloud ERP adoption by SMEs has been hampered by the high costs involved with upgrading/updating, maintenance, and integration.

Usman, Ahmad, and Zakaria (2014) identified various barriers in the process of implementing and maintaining ERP systems in SMEs. The most significant are the customization of ERP and the reengineering of business processes. The mentioned barriers must be dealt with by SMEs throughout the entire ERP implementation lifecycle. Although cloud ERP systems offer numerous technological advantages, their customization is limited. Additionally, it imposes a heavy

financial burden on the client organization once it is completed. The following barriers were also identified in addition to the most significant ones: insufficient flexibility in adapting to business processes, and long or incomplete integration.

Moreover, they examined the key influencing factors that prevent ERP systems from being successfully adopted. They include: top management's lack of leadership/commitment, availability of technical and business specialists (skilled resources) in the organization, internal change management during business process reengineering, ERP system selection preceded by an inadequate definition of functional requirements, ineffective communication between management at different levels and ERP vendors, unrealistic expectations from the ERP system (the so-called cost benefit utopia), which is reflected in the belief that ERP is an intelligent solution to all organizational business problems such as customer satisfaction, product quality, and finding product defects. Inadequate end user training due to inadequate assessment of the budget, time and resources required, centralized decision-making and resistance to change in SMEs, and redundant ERP vendor processes that are not required by SMEs, are some of the other key factors influencing cloud ERP adoption (Venkatraman/Fahd 2016).

According to Gupta et al. (2017), cloud ERP barriers can be classified into those that relate to the adoption and implementation phase. The former include: size of the organization, implementation costs, dependence on the Internet, and sensitivity to user needs. The latter include: minimal required IT infrastructure, fast and easy implementation, ensuring ERP regulation by vendors, adapting to the specific needs of SMEs and maintaining a stable system for large companies.

When switching to cloud ERP systems, organizations have experienced the automation of system updates by the ERP vendor, i.e. lack of control over cloud ERP system updates. In addition to the obvious advantages of free updates and an up-to-date cloud ERP system, there are also some disadvantages. These disadvantages are reflected in the fact that organizations do not have any control over the update of the cloud ERP system, as the cloud ERP provider is entirely responsible for this process. As a result, organizations may interpret these updates as forced, since they were made without their consent.

Haddara, Gøthesen and Langseth (2021) identified the following barriers during the adoption of cloud ERP systems in companies. The first aspect is adaptability to changes, which includes barriers such as change management control list, new features and flexibility in customization. The second aspect includes system migration to the cloud, which entails barriers such as application migration and platform migration. The third aspect represents system performance, which includes characteristics such as response time and system availability. Cloud ERP's performance is directly related to the Internet's speed, so high-speed Internet is essential for cloud ERP's high performance. There may be a delay in response time when dealing with a large number of business processes and a large amount of data in the cloud ERP system. Cloud ERP is even more dependent on Internet availability and speed in such situations (Hustad et al., 2020). The fourth aspect of the challenge involves choosing a cloud ERP provider, which includes market research, the ability of the implementation team, and cost-effectiveness analysis. The final fifth aspect represents user satisfaction, which includes business process mapping, the look and feel of using the software, and the simplicity of the process.

According to Hasheela and Smolander (2014), the implementation of ERP systems is time-consuming and involves a high risk of failure or disruption of business operations, which is part of the obstacle to their adoption.

According to Gupta and Misra (2015), a lack of adequate and comprehensive information about the features of cloud ERP systems often leads to suspicion and confusion among decision makers in organizations. This can lead to misperceptions and misconceptions, such as fears about data security and privacy (for instance, "some managers might think that using online-based ERP system like Cloud ERP would endanger the security and privacy of their data"). Research has also shown that there are mixed results and inconclusive evidence regarding the impact of cloud ERP system implementation on the decision-making process in organizations. Despite some studies indicating that cloud ERP systems are successful, some report contrasting results. There are also barriers such as organizational support, competitive pressure, adaptability and integration limitations.

Øverdal, Haddara, and Langseth (2023) focused their research on the barriers of cloud ERP systems specific to public enterprises. The rigid nature of supplier selection is the main challenge, which is further complicated by the size of the public enterprise, significantly impacting the choice of cloud ERP supplier. Since these are public enterprises, they must procure cloud ERP systems through a public procurement process. A major problem is the lengthy public procurement process, often resulting in the acquisition of cheaper, and consequently lower-quality, cloud ERP systems in terms of their characteristics.

In their study, Tongsuksai, Mathrani and Weerasinghe (2021) identified the barriers of implementing cloud ERP systems for SMEs from the perspective of cloud ERP system providers. The results of the study showed that cloud ERP system providers face the following barriers: cost overruns, lack of information compatibility between departments, project team changing during the implementation process, lack of governance inside the organization, lack of training, CSPs or consultants becoming unavailable and over-estimating cloud ERP efficiency.

Awan et al. (2021) conducted a study to identify barriers in SMEs' adoption of cloud ERP systems. There are ten barriers identified by the research: reliability of the Internet, lack of awareness, user resistance, limited functionality, vendor trust and lack of knowledge. Since cloud ERP relies on real-time data connections, it is dependent on the network (the Internet). Consequently, the usability of the cloud ERP system is undoubtedly affected by the quality of the Internet, as measured by the connection speed and stability available at specific physical locations. As a result, network dependency is a risk associated with adopting a cloud ERP system model, because cloud ERP systems rely on

high-quality Internet connections to function (Paulsson/Johansson 2023). It has already been mentioned that the reliability of the Internet is crucial for cloud ERP systems, and in some countries it is questionable. Such circumstances inevitably raise the question of whether cloud ERP systems are suitable for such countries (Awan et al. 2021). Lack of awareness in organizations leaves the question of how cloud ERP will be adopted in an organization that has very little or no knowledge of it. The resistance of users to something new like cloud ERP is to be expected. First and foremost, employees want to know if their jobs are secure after cloud ERP adoption. Secondly, the knowledge and skills related to using cloud ERP do not match those of the previous system. The training of employees is therefore necessary. It is believed that traditional ERP systems are old and mature, so cloud ERP takes time to mature. The limited functionalities of cloud ERP force organizations to revise their own business processes according to cloud ERP in order to fully map them.

The perception of vendor trust is expressed by concerns about the capability and capacity of certain local cloud ERP vendors. Support from vendors may be lacking in certain situations, so organizations with sufficient resources prefer to develop their own solutions. Trust is not only established by the reputation of a vendor, but also by the agreement with a vendor. External pressure is defined as an indicator of the adoption of new technology. Cloud ERP is a technology that client organizations and their employees are under constant pressure to adopt because their competitors already use it. When moving to cloud ERP, a company may encounter problems during adoption due to a lack of knowledge and experience of its employees. There is no doubt that knowledge and experience are acquired over time, and that lack of knowledge is an entirely natural phenomenon in the adoption of any new technology, including cloud ERP (Awan et al. 2021).

Paulsson and Johansson (2023) identified architectural barriers and countermeasures that large companies should consider when adopting cloud ERP systems. They determined two architectural barriers that had not been discussed before: system mobility and scalability.

Modern cloud ERP systems are accessible via mobile devices, such as tablets and mobile phones. In other words, the system can be accessed anywhere and at any time. Access to ERP systems is not limited to the physical office or desktop computers where they are installed. A cloud ERP platform enables system mobility, which improves business decision-making and performance. Despite this, mobility presents organizations with new types of risks on many levels. First of all, mobile devices can be lost or stolen, compromising data security and privacy. Second, in line with the bring-your-own-device culture, where companies encourage employees to install work-related apps on their own mobile devices, users tend to install different types of applications. Applications with sensitive data, such as cloud ERP systems, may be at risk as a result of this behaviour (Zhong, & Erik Rohde, 2014).

The literature on Cloud ERP systems frequently emphasizes scalability as a positive attribute. Risks associated with scalability are ignored. First, scalability depends on a well-designed and implemented cloud infrastructure. If these basic aspects of cloud infrastructure are not met, scalability will not be possible. Second, scalability is often taken for granted. Scalability is expected to be available whenever client organizations need it. However, cloud service providers are also subjected to limited processing and storage capacities. Although those capacities are limited, it also depends on how cloud service providers can use additional technologies to efficiently and effectively allocate resources to where they are needed most.

## CONCLUSION AND FUTURE RESEARCH

In both SMEs and large organizations, cloud ERP has become a dominant type of information management system. In addition to the obvious benefits it brings, given that it is the last and relatively new generation of ERP systems, the authors of the paper were interested in analysing the barriers during its implementation and adoption, in order to highlight potential risks that could be experienced by organizations that implement cloud ERP systems. For the purpose of discovering and systematizing the barriers associated with cloud ERP implementation and adoption, a literature review method was used to review, up to the time of writing this paper, the published papers on this topic. As a result of the literature review, it was possible to identify scientific papers that addressed this topic. An in-depth analysis of the papers led to research findings relating to barriers in the adoption and implementation of cloud ERP systems. Several characteristics and specifics of certain barriers point to numerous potential problems companies will face during this complex process. It is essential for all relevant organizational units and top management in companies to become familiar with the numerous barriers observed and described if they are to be able to successfully implement and adopt cloud ERP systems.

This paper is an initial step for future research, which will focus on identifying barriers in the life cycle of cloud ERP systems by conducting a systematic literature review (SLR). Once SLR is completed, empirical research will reveal ways to overcome the most critical barriers identified for an organization.

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**Strategic Management**and Decision Support Systems  
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**Glušević Luka**University of Novi Sad, Faculty of Economics  
in Subotica  
Subotica, Serbia  
luka.gluscevic@ef.uns.ac.rs**Grljević Olivera**University of Novi Sad, Faculty of Economics  
in Subotica  
Subotica, Serbia  
olivera.grljevic@ef.uns.ac.rs**Marić Mirjana**University of Novi Sad, Faculty of Economics  
in Subotica  
Subotica, Serbia  
mirjana.marić@ef.uns.ac.rs

## **EXPLORING USER SATISFACTION: A TOPIC MODELING APPROACH**

**Abstract:**

In today's highly competitive market for mobile business applications, user demands and expectations are continuously rising and evolving rapidly. As a result, companies increasingly focus on enhancing user satisfaction and fostering customer loyalty, as these are essential for a stable and reliable source of revenue, as well as for spreading positive word-of-mouth and acquiring new users. Conducting evaluations of user experience for mobile business applications is crucial for their ongoing improvement, as user experience directly impacts user satisfaction and customer loyalty. In this paper, the authors provide a step-by-step methodology for exploring user satisfaction using topic modeling, demonstrated through a case study on Salesforce. Salesforce is one of the most popular cloud-based CRM solutions. By reviewing the literature, the authors didn't find a similar case study on Sales Force. The authors have organized the results of their empirical research into groups of factors influencing positive (e.g. intuitive interface and efficiency in solving tasks related to customer relationship management) and negative user satisfaction (e.g. performance issues, system crashes, and slow operation) with the Salesforce application.

**Keywords:** user satisfaction, user experience, topic modeling.

## **INTRODUCTION**

The sustainability of the business relies on user satisfaction and positive user experience. The satisfied user remains loyal to the brand, promotes products or services in their community, and influences others' purchase decisions. Monitoring user satisfaction helps companies identify customer needs and areas of improvement to enhance products or services. Maintaining high levels of user satisfaction becomes even more relevant during crisis times. Prioritizing user needs and addressing them helps companies build a loyal customer base and their resilience and adaptability in times of crises, which contributes to the long-term sustainability of a company.

Modern digital technologies have led to a dramatic growth in today's development of mobile business applications, which can be found in the Google Play and Apple stores. Evaluating the user experience of mobile business applications is an important aspect of their sustainability in a rapidly growing and highly competitive market, as it directly impacts user satisfaction and customer loyalty. This research aimed to investigate, based on online reviews of Salesforce collected from Google Playstore, what kind of user satisfaction there is with the Salesforce mobile application, for the reason that it is the first step for the improvement of any product.

In the context of this research topic, the authors aimed to answer the following research question through the results of empirical research:

*RQ1. Which factors of user experience affect mobile users positively, and which affect them negatively?*

In this paper, the authors offer methodological steps for exploring user satisfaction using topic modeling, illustrated in a Salesforce case study. Salesforce is one of the most widely used cloud-based CRM solutions. Topic modeling is a technique that reveals hidden thematic structures, referred to as topics, from a collection of texts based on keywords,

which reflect the most salient information in text documents (Maier, et al., 2018). In addition to discovering topics, topic modeling can reveal the relationships between topics and help track their development over time. It tracks trends, emotions, rumors, and factors influencing service or product consumption.

The research methodology comprises five tasks 1) Data collection and cleansing, 2) Data pre-processing, 3) Selection of a suitable topic modeling approach, 4) Identification of the optimal number of topics, and 5) Interpretation of the resulting topic model. The dataset comprises 9,308 user-generated online reviews of Salesforce collected from Google Playstore. The authors created three data subsets based on the ratings associated with collected reviews. Reviews rated with one or two stars are referred to as negative reviews and comprise the first data subset. Reviews rated with three stars, mixed sentiment reviews, comprise the second data subset, while the third is the collection of the reviews rated four and five stars. Topic models are built for each review subset. The main findings refer to the following. Negative Salesforce user experiences are caused by performance issues, system crashes, or slow operation, especially manifested on the Android platform. Software anomalies, such as blank screens and login difficulties also cause frustration among users. A positive experience is built thanks to the intuitive interface of the Salesforce mobile application and efficiency in solving tasks related to customer relationship management. People having the mixed reviews, write positively about the application performance but express concerns about the need for excessive adjustments. The findings gained from topic modeling analysis represent valuable insights for the company, which can serve as a direction for product improvements.

The paper is organized as follows. The first section provides the literature review reflecting the importance of user satisfaction monitoring, and the sustainability of the business. The following section gives an overview of the research methodology. Section *Research Results* presents resulting models and provides insights into Salesforce mobile application user experience and satisfaction. Concluding remarks are presented in the section *Conclusion*.

## 1. BUSINESS ASPECTS OF USER EXPERIENCE

The fourth industrial revolution and modern digital technologies have influenced the strengthening of the customer's role and their significant differentiation in the global market. Customers today have the ability to switch companies they buy products and services from with just one click. For this reason, companies, in addition to understanding, predicting, and meeting specific customer needs and desires, have focused on building their loyalty. Loyalty can be defined as the intention of customers to continuously choose a specific brand or company to purchase products or receive services from. A larger base of loyal customers contributes to higher company revenues, positive word-of-mouth marketing (WoM), and gaining a competitive advantage in the market (Arslan, 2020; Rane et al., 2023).

Building loyalty directly contributes to user satisfaction and user experience. User satisfaction represents the level of satisfaction of customers after using a company's product/service. Satisfied customers tend to make repeat purchases and thus show loyalty to the company. Loyal customers are crucial for a stable and reliable source of company revenue because they buy more frequently and in larger quantities than new customers. Furthermore, satisfied customers contribute to positive word of mouth (WoM), as they often recommend the product/service to their friends and family, which contributes to acquiring new customers, expanding the market, and increasing brand recognition. A satisfied customer is more likely to become a loyal customer, who perceives the company as a partner, providing valuable feedback on products/services, based on which they can be improved to enhance user experience (Arslan, 2020; Rane et al., 2023).

User experience encompasses all interactions that customers experience during the process of purchasing and using products/services. User experience is a holistic concept that includes interactions between customers, companies, and the company's offerings. It involves sensory, social, emotional, cognitive, affective, spiritual, and physical responses of users to all interactions with the company. Positive user experience will develop a positive emotional value for customers, which will impact the increase in customer satisfaction (Kumar & Mokha, 2021).

In this paper, the authors focused on exploring user experience in the domain of business mobile applications, as this market is rapidly growing. The increasing number of business apps on Google shows how important it is for these apps to be easy to use. The most successful companies, such as Google, iPhone, SAP, and Salesforce, see user experience as a key success factor and a source of innovation. Consumers buy and use business mobile applications based on their design, usability, and attractiveness. Regardless of whether a company strategically addresses user experience or not, consumers will still have it. Poor user experience of mobile business applications will lead to decreased revenue, customer dissatisfaction, negative ratings and comments, negative WoM, and a negative impact on the brand (Sabukunze & Arakaza, 2021; Hussain et al., 2017; Liang et al., 2015).

Companies aiming to strategically approach designing good user experience must iteratively conduct the following three phases of this process. The first phase involves researching user needs, characteristics, behaviors, and usage context of the product/service. The second phase involves using the results obtained from the previous phase, in which business and user needs are explored, to design a solution that follows human factors principles and design best practices. The third phase of the good user experience design process is evaluating the solution made together with users, by conducting usability testing. Based on the results obtained, changes need to be made to the initially designed solution. The described process is iterative and standardized by the International Standards Organization (ISO) with ISO 9241-210: "Human-centered design for interactive systems." Investments by companies in positive user experience

provide a significant return on investment ranging from a return of \$2 to \$100 for every \$1 invested in user experience design (Ross, 2014). In the empirical research reported in this paper, the authors presented how topic modeling can be used in the first two phases of the described process.

## 2. METHODOLOGY

The research presented in this paper aims to identify the sources of satisfaction and dissatisfaction of users of the Salesforce mobile application and to depict their user experience, providing guidelines for product improvement and marketing campaign design. The methodology, designed to guide researchers and practitioners in similar tasks, comprises five tasks: 1) Data collection, 2) Data cleansing and pre-processing, 3) Selection of a suitable topic modeling approach, 4) Identification of the optimal number of topics, and 5) Interpretation of the resulting topic model.

**Data collection.** For the case study presented in this paper, the authors use 9.308 online reviews, reflecting the opinions and attitudes of mobile application users, collected from the Google Play Store using custom-written Python code for scraping. The authors created three data subsets based on the star ratings associated with reviews. The negative review subset contains 2.501 reviews rated with 1 or 2 stars, the mixed sentiment subset comprises 705 reviews rated with 3 stars, while the positive subset contains 6.102 reviews rated with 4 or 5 stars.

**Data cleansing and pre-processing** have tasks of raising the corpus quality and transforming the data into a format suitable for selected machine learning algorithms. The goal is to eliminate noise from the data and create a cleaner dataset. The collected data was pre-processed in the following manner. All text was lowercase to minimize the dimensionality of the data, as machine learning algorithms treat different word forms, such as capitalized, uppercased, or lowercase, as different dimensions. Authors removed punctuation, numeric values, redundant characters, and newline characters from the texts, as they introduce noise in the data and do not add new knowledge or information about the text. Stopwords are removed from the text. These words have no semantical meaning but are commonly used in the written or spoken language, such as *and*, *or*, *but*. Text is tokenized, i.e., split into smaller units - words, for facilitating lemmatization as the next step of data pre-processing. Lemmatization is the text normalization process, which reduces words to their base form – the lemma – and decreases data dimensionality. For example, the verb *going* and its forms *gone* and *went* would be lemmatized to the base form *go*. Missing values, data instances without the full text of a review, are removed from the text.

**Selection of topic modeling approach and identification of optimal number of topics.** Authors Abdelrazek, Eid, Gawish, Medhat, & Hassan (2023) classify topic modeling approaches into four categories: algebraic, fuzzy, probabilistic, and neural. The subject of analysis in the case study presented in this paper is online reviews of the Salesforce mobile application. Online reviews are considered a short text and for conducting topic modeling over short text the probabilistic LDA approach is the most commonly used, as indicated by authors (Laureate, Buntine, & Linger, 2023). Authors Laureate, Buntine, & Linger (2023) emphasize that 79.79% of studies dealing with short text, encompassed in their systematic literature review, use LDA topic modeling. Following this finding, we have selected the same approach for topic modeling for our case study. LDA aims to extract groups of keywords - topics - that often appear together in documents (Grljević, 2023). The main assumptions of LDA modeling are: 1. words appearing together are associated with the same topic, 2. each document is represented as a distribution of topics, and 3. each topic is represented as a distribution of keywords (Grljević, 2023). The optimal number of the topic is unknown. During the experimentation and fine-tuning, the data analyst searches for the optimum by varying values for the number of topics and two crucial hyperparameters, alpha ( $\alpha$ ) and beta ( $\beta$ ), which affect the granularity and diversity of identified topics (Egger, 2022). Alpha influences the number of topics representing each document. Beta influences the number of words describing topics. For each variation of their values, a model is built and its quality is assessed using topic coherence measure. Topic coherence measures the frequency of co-occurrence of leading words in a topic (Egger, 2022; Rosner, Hinneburg, Röder, Nettleing, & Both, 2013). In the modeling process, multiple models with different parameter settings are constructed and the model with the highest coherence score is selected (Maier, et al., 2018).

The last step in topic modeling is **discussing the resulting topic model**, which should provide insights about leading topics influencing user experience. Section *Research Results* presents resulting models and provides insights into Salesforce mobile application user experience and satisfaction.

## 3. RESEARCH RESULTS

For each data subset, positive, negative, and mixed sentiment, the authors developed a series of LDA-based topic models for different values for the number of topics  $K = [2, 15]$  and hyperparameters  $\alpha = [0.01, 0.31, 0.61, 0.91]$  and  $\beta = [0.01, 0.31, 0.61, 0.91]$ . Models with the highest coherence score are selected as optimal for each data subset. In the following sections, each topic model is presented with more details. Their analysis provides insights on user experiences with the Salesforce mobile application. The general conclusion is that users of the Salesforce application mostly experience issues regarding incompatibility of the application with different mobile devices, users consider the application unreliable, it loads slowly and requires frequent updates, users feel discomfort with the amount of

notifications. Satisfied users express positive opinions about application functionalities, customer support, user experience, and performance. Users with mixed sentiments have both of all, so they express positive and negative critics of Salesforce functionalities.

### 3.1 Topic modeling on negative sentiment reviews

For the negative subset of reviews the highest coherence score, 0.645, is achieved with  $K = 11$ ,  $\alpha = 0.61$ , and  $\beta = 0.61$ . The discovered topics in the negative reviews point to the sources of dissatisfaction among Salesforce mobile users, and the aspects for potential product improvements that will enhance user satisfaction and experience.

**Topic 1: User interaction and challenges** with functionalities indicate that users have problems with basic functionalities considering them useless and redundant. The users experience difficulties in using them.

**Topic 2: Device interactivity and performance** indicate that users express frustrations with compatibility on different devices, and highlight threats about usability. Users also report that there are responsiveness problems on devices of different sizes such as tablets, laptops, PC and mobile. Users also report problems with payment methods, logout, and service support.

**Topic 3: Performance and reliability problems** indicate problems with data processing speed, as well as data management. Complaints include frustrations with slow performance and difficult file management and highlight stability problems.

**Topic 4: Functionality and usability feedback** indicate problems like slow page load time and often application updates. Also, highlight problems with production and compatibility with different devices. They also indicate the need to improve navigation, which doesn't fulfill users' expectations.

**Topic 5: The notification and performance system** is the most represented topic and contains 33.3% of the corpus. Users express their complaints about the services and restricted information. They also highlight user authentication and performance problems.

**Topic 6: Problems with the interface and dashboard** indicate system errors, a slow response time of the interface for adding and uploading data for user access, as well as displaying information on the dashboard. Highlighting is also on problems in interface design and customer experience.

**Topic 7: Service quality and support** indicates users' dissatisfaction with the platform's service quality and support. Users indicate problems such as slow response times, incorrect information, and irregular offline functionality.

**Topic 8: Interface and Functionality problems** indicate that user frustration with reliability and performance remains and that there are several recurring problems. The lack of user interest is also pointed out, due to problems with the interface and performance itself, and they emphasize that these problems should be fixed.

**Topic 9: Constant instability and user frustration** indicate that users have problems with frequent crashes and freezes, and express their negative experiences. Problems with errors and the need for frequent reconfiguration are common. The users emphasize the need for frequent reinstallations of application thinking it will solve the problems, which leads to their waste of time.

**Topic 10: Compatibility and installation errors** indicate that users are experiencing installation errors on Android devices, and are reporting errors of usability on older devices. Also, there are problems with updating, and some people uninstall application because of these problems, and they say that the installation process is very complicated, especially for Android devices.

**Topic 11: Login and authentication problems** indicate that there are problems accessing accounts, as well as problems entering login credentials, and often run into a blank screen. Some users report that they received error messages and not being able to move past the login screen.

### 3.2 Topic modeling on mixed sentiment reviews

For the mixed subset of reviews the highest coherence score, 0.677, is achieved with  $K = 3$ ,  $\alpha = \text{asymmetric}$ , and  $\beta = 0.91$ . These topics encapsulate both positive and negative sentiments. Their analysis allows the authors to reveal areas of satisfaction and areas requiring improvement, and to provide actionable insights for enhancing user satisfaction and overall experience.

**Topic 1: Functionality and user experience** comprise the most represented part of the corpus, 70.2%. Users express frustration regarding application performance. They are not satisfied with the speed and innovation of the application and seek for improvement of the user experience.

**Topic 2: Performance and user experience** indicate that long page loading time, displaying notifications, and availability raise nervousness among the users. The highlighting is on the significance of optimizing those features and improving the user experience problems.

**Topic 3: Language and word processing problems** indicate problems with grammar, syntax, and text quality. Mistakes in poor translation, language choice, and changes in language structures were highlighted. Users also point to problems with data storage and data quality.

### 3.3 Topic modeling on positive reviews

For the positive subset of reviews the highest coherence score, 0.671, is achieved with  $K = 8$ ,  $\alpha =$  asymmetric, and  $\beta = 0.91$ . Through analysis of the resulting optimal topic model, the authors identified key topics that signify users' satisfaction.

**Topic 1: Positive user experience and satisfaction**, as the most common topic in positive sentiment reviews, accounts for 49.5% of the corpus. Users are satisfied, and highlight the ease of use of the application. They point out that the application is very effective, especially in sales and CRM, and highlight its benefits for conducting everyday tasks.

**Topic 2: Positive experience and system implementation** indicate that users are satisfied with the simplicity of use. The users emphasize how useful the application is in solving daily tasks and problems and highlight the help in increasing their productivity in everyday activities. These users also love the speed of page load.

**Topic 3: Positive performance and user experience** indicate that users agree with the functionality of the application and the services it provides, and they are also satisfied with the design of Salesforce. These users indicate cloud-based functionality and customer support as particularly favorable aspects of the application.

**Topic 4: Requests for improvements and updates** indicate that users suggest improvements in the area of frequent updates. They express interest in access from different devices.

**Topic 5: Reporting problems and suggestions** indicate that users are writing and evaluating mobile application notifications. They highlight that application provides redundant, often unnecessary information and indicate the need for application improvement in this area. They seek improved control over the notification system, requiring options that will allow them to control which notifications they will receive.

**Topic 6: Praise of the user experience** indicates the user's satisfaction with the user experience itself and satisfaction of its features and functionality, especially in providing support in case when problems arise. The design brings them improvements in solving everyday business obligations in relationships with customers.

**Topic 7: Usability and problem-solving** indicate that users have a positive opinion of the interface and functionalities, highlighting simple design and integration with other applications. Users want to have better training for application use, to have better usability.

**Topic 8: Feedback and suggestions** indicate that users have suggestions about how the application works. They often mention the word "developer" to indicate the problems they are experiencing or asking help for. This topic discusses the importance of getting feedback to improve performance and experience.

## CONCLUSION

The goal of the research presented in the paper is to understand the perception and experience of Salesforce mobile application users. The authors used online reviews as the main data source of user opinion and using topic modeling they identified key topics that appear in the reviews, which describe the attitudes and experiences of users. Users express different levels of satisfaction, negative, mixed, or positive, directed toward application functionalities, bugs, or overall user experience, and often provide suggestions for improvements. Positive sentiment indicates that users are satisfied with the application and its aspects. They consider the application to be simple with high levels of protection and supportive of their business needs. Negative sentiment is directed towards mobile application failure and errors, functionalities, levels of protection, or user experience. Reviews with negative semantics indicate the need for further development and improvement of the application to increase user satisfaction. The results and insights obtained through

the topic modeling analysis are useful for building user loyalty, which is important for market survival, and improvements of the application.

Dependence on one data source, the Google Play store, which provided valid but limited information about user experiences with the Salesforce application can be considered as the main limitation of the presented study. The authors obtained valuable insights into users' sentiments and opinions, however, data may not be representative of all users. Not all users of mobile applications leave reviews about their user experience and they may not share the prevailing opinion. The research is limited in terms of the attributes included in the analysis. The research is based on topic modeling over online reviews and other more traditional factors influencing user experience, such as demographics, location, and consumer roles, which can provide additional insight into customer satisfaction, were not included in the analysis as the data source does not provide them.

The future research directions are various. One could refer to the expansion of data sources, such as online reviews from other reviewing sites, data from various social media sites, direct surveys, or even interviews. Application of different topic modeling approaches, such as Structural topic modeling or Non-negative matrix factorization, would allow comparison of the results and goodness of fit of other approaches to data. Comparison with competitors through parallel analysis of online reviews of other providers, such as SAP CRM. The comparative analysis could provide insight into the market position of Salesforce, compare products based on user opinion, experience, and satisfaction, and indicate strengths and weaknesses of the application compared to competitors.

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**Miloš Đaković**

University of Novi Sad, Faculty of Economics  
 in Subotica  
 Subotica, Serbia

e-mail milos.djakovic@ef.uns.ac.rs

**Nada Milenković**

University of Novi Sad, Faculty of Economics  
 in Subotica  
 Subotica, Serbia

e-mail nada.milenkovic@ef.uns.ac.rs

**Jelena Andrašić**

University of Novi Sad, Faculty of Economics  
 in Subotica  
 Subotica, Serbia

e-mail jelena.andrasic@ef.uns.ac.rs

## **THE EFFECT OF RECENT CRISIS SITUATIONS ON THE SUSTAINABILITY OF INDEBTEDNESS OF THE MANUFACTURING SECTOR OF SERBIA**

**Abstract:** This study investigates the impact of recent crisis situations on debt sustainability in the manufacturing sector of Serbia. Focusing on the economic and financial challenges facing the sector after the crisis, covering the period from 2015 to 2023, the research uses a comprehensive analysis of key indicators such as levels of total, short-term, and long-term debt as well as liquidity and profitability. Examining the dynamics of indebtedness during crisis periods, the study aims to show the resilience and adaptability of the sector to adverse economic conditions. The findings will contribute to a better understanding of the manufacturing sector's ability to sustain indebtedness in times of crisis and inform policymakers, industry stakeholders, and financial institutions about potential strategies to enhance financial stability and sustainability within the sector.

**Keywords:** Debt, Manufacturing sector, Indebtness

### **1. INTRODUCTION**

Capital structure, often known as a company's debt-to-equity to debt-to-asset ratio, provides information about a company's creditworthiness and ability to pay its debts. One of the company's main issues is likely to be maintaining the right ratio of debt to equity financing. Gaspariene (2022) argues that many companies like to use debt as seed money to start or continue their specific business operations. Data on the source of financing is important for a company because it indicates the proportion of its operations that are financed by external and internal resources (Horobet et al., 2021). A firm's capital structure affects several things, including its capital expenditures, risk exposure, liquidity, investor returns, and business valuation. For financial managers, the choice of financing source is always the most important and challenging decision because it affects the cost and availability of cash for the business. By definition, a company's capital structure is the ratio of debt to equity that it uses to finance its operations. Depending on the frequency and maturity of the income (long or short), debt financing takes different forms. Three forms of equity financing are available: common stock, preferred stock, and retained earnings. A company's debt-to-equity ratio, or capital structure, tells us a lot about how risky and financially stable the company is. Maintaining the right debt-to-equity financing ratio is certainly one of the company's main problems. The manufacturing sector in Serbia is a vital component of the country's economy, contributing significantly to job creation, growth, and innovation. Serbia has a long and rich industrial history that dates back centuries. With the help of its advantageous location, highly qualified labor force, and strong infrastructure, Serbia has developed into a thriving manufacturing hub. A wide range of industries, from textiles and electronics to machinery and automobiles, flourish inside its boundaries and provide substantial contributions to the GDP and export earnings of the country. In addition to overcoming economic hardships, Serbia's industrial sector's tenacity has helped the nation advance toward sustainable development and international competitiveness. To maintain the stability of the sector, which is of great importance for economic growth and development, it is necessary to draw attention to the debt levels of companies in the sector.

The paper is composed of five sections. The first section included the introductory considerations as well as stating the subject and goal of the research. The next section includes a review of the relevant literature, which mentions the studies carried out so far in the field of capital structure and reviews several main postulates of theories of capital structures, such as the theory of relevance, irrelevance, "Trade-off", "Pecking order theory". The third section includes the methodological framework of the work, where relevant diagnostic tests and econometric models that were applied in the research are listed. The fourth section includes a presentation of the research results as well as a discussion of their meaning. The last section includes a concluding discussion where the obtained results are summarized as well as suggestions for further research along with the limitations of this study.

## 2. LITERATURE REVIEW

Modigliani and Miller's (1963) theories of relevance and irrelevance served as the basis for the theory of capital structure. The theory itself suggests that in a perfect market, the capital structure of a firm is irrelevant to its market value, while the relevance theory considers factors like taxes and bankruptcy costs. Economists have continued to develop several other theories of capital structure over time, including the Pecking order theory (Myers, 1984) which suggests that firms prioritize internal financing over external financing, preferring debt over equity issuance to maintain financial flexibility. Trade-off theory (Kraus & Litzenberger, 1973) states that firms balance the benefits of debt, such as tax shields and increased leverage, against the costs, such as financial distress and agency conflicts, to determine their optimal capital structure. Stakeholder theory (Titman, 1984) posits that businesses should consider the interests of all stakeholders, including employees, customers, suppliers, and the community, in addition to shareholders, when making decisions, and many more theories of capital structure.

The influence of the debt ratio on profitability ratios, such as total liabilities to total assets and total equity to total assets, was investigated in the studies of Habini, Dsouza, Rabbani, Navaz & Demiraj, 2022; Huong, 2023; Ilie & VasIU, 2022. The leverage ratio was shown to have a significant impact on the return on assets ratio, but it had a smaller impact on the return on equity. Companies prefer to use their funds for financing, according to the findings of Moscu, Prodan, and Grigorescu (2014). If they decide to finance with debt, it is best to do it first through the issue of shares, then through short-term and finally long-term debt. According to Kumar & Gupta (2022), a firm's decision to use financial leverage is influenced by a number of factors, including trade risk, firm age, tangibility, liquidity, profitability, business size, tax rate, and tax rate. Studies by Gajdosikova, Lazaroiu & Valaskova (2023); Gajdosikova, Valaskova, Kliestik & Kovačova (2023); and Iiadom, Mavutor, Amankva & Iallei (2020) found statistically significant differences in the leverage coefficient values based on company size and legal form organization. These findings supported previous research on identifying key internal factors that affect a company's debt. Researchers like Ersoi (2022), Ranjan (2021), Mazanec (2023), Ilie & VasIU (2022), Tien (2023), Boshnak (2023), Roman, Rusu & Ghita-Mitrescu (2017) and Milovanović, Bašić & Bubaš (2022) confirmed the conclusions that debt maturity is largely influenced by factors such as business size, liquidity and maturity of funds. Also, studies by Gajdosikova, Lazaroiu & Valaskova (2023); Gajdosikova, Valaskova, Kliestik & Kovačova (2023); and Iiadom, Mavutor, Amankva & Iallei (2020) found statistically significant differences in the leverage coefficient values based on company size and legal form organization. These findings supported previous research on identifying key internal factors that affect a company's debt.

## 3. METHODOLOGY AND DATA

The research includes an analysis of 8 companies from the manufacturing sector, listed on the Belgrade Stock Exchange. The period from 2007 to 2022 was covered, while the segmentation was carried out into crisis and post-crisis periods. The period from 2007 to 2009, as well as the period from 2019 to 2022, is classified as a crisis period, while the post-crisis period includes the years 2010 to 2018. The segmentation was performed to better understand the effects of microeconomic and macroeconomic variables. Table no. 1 below shows the dependent and independent variables used as well as the methods of their calculations.

**Table 1:** Dependant and independent variables

Variable	Measure	Symbol
Dependant variables		
Total debt (pre-crisis)	Total debt / Total assets	CrDEBT
Total debt (post-crisis)	Total debt / Total assets	PcrDEBT
Independent variables		

General liquidity	Current assets / Current liabilities	GL
Profitability	Neto profit / Total assets	ROA
Size	Logarithm on assets	LnAssets
Tangibility	Tangible assets / Total assets	TAN
Gross domestic product	% growth of GDP	GDP
Inflation	CPI index	INF
Corporate tax rate	Annual tax rate	TAX

Source: author's

Based on defined segmentation criteria as well as dependent and independent variables, the authors generated the following equations:

$$CrDEBT_{it} = \alpha + \beta_1 GL_{it} + \beta_2 ROA_{it} + \beta_3 LnAssets_{it} + \beta_4 TAN_{it} + \beta_5 GDP_t + \beta_6 INF_{it} + \beta_7 TAX_{it} + \varepsilon$$

$$PcrDEBT_{it} = \alpha + \beta_1 GL_{it} + \beta_2 ROA_{it} + \beta_3 LnAssets_{it} + \beta_4 TAN_{it} + \beta_5 GDP_t + \beta_6 INF_{it} + \beta_7 TAX_{it} + \varepsilon$$

Where are:

CrDebt<sub>it</sub> = Dug prema imovini u kriznom periodu ratio za preduzeće I u vremenskom periodu t

PcrDebt<sub>it</sub>=Dug prema imovini u post kriznom periodu ratio za preduzeće I u vremenskom periodu t

GL<sub>it</sub> = Racio likvidnosti za preduzeće I u vremenskom periodu t

ROA<sub>it</sub> = Racio profitabilnosti za preduzeće I u vremenskom periodu t

LnAsset<sub>stit</sub> = Veličina kompanija I u vremenskom periodu t

TAN<sub>it</sub> = Racio opipljivosti za preduzeće I u vremenskom periodu t

GDP<sub>t</sub>= Stopa rasta GDP u vremenskom periodu t

INF<sub>t</sub>= Stopa rasta Inflacije u vremenskom periodu t

TAX<sub>t</sub>= Stopa rasta stope poreza na dobit u vremenskom periodu t

Table no. 2 below shows the descriptive statistics of the variables used in both models. Model 1 statistics show that general liquidity, GDP growth, and inflation had the highest level of standard deviation which means that in the case of those variables, the trend during the crisis period was more prone to big swings. In model 2 the same variables also showed the highest levels of standard deviation but on a smaller level compared to the crisis period. The general liquidity variable showed the greatest levels of standard deviation. The disparity between the highest and lowest levels of general liquidity was shown to be in the crisis period compared to the post-crisis period where even though the standard deviation of liquidity was still high the disparity was smaller.

Table 2: Descriptive statistics

Variables	Mean	Max	Min	Std. Dev.	Obs.
Model 1					
DEBT	0,42510	0,94315	0,03700	0,23740	63
GL	2,95757	42,40800	0,30400	6,35228	63
ROA	0,02518	0,25687	-0,24250	0,07535	63
SIZE	6,16287	7,17814	5,04118	0,54593	63
TAN	0,69026	0,90778	0,36242	0,15488	63
GDP	3,57047	7,38900	-2,73200	3,40640	63
INF	6,97040	12,41100	1,57500	4,06499	63
TAX	0,12540	0,15000	0,10000	0,02520	63
Model 2					
DEBT	0,41876	1,01770	0,00700	0,29215	72

GL	2,93190	29,80800	0,19700	5,01478	72
ROA	0,04424	0,26847	-0,20990	0,07707	72
SIZE	6,18503	7,10054	5,34441	0,49632	72
TAN	0,68520	0,89133	0,27837	0,17490	72
GDP	1,67760	4,49500	-1,59000	1,82729	72
INF	4,66560	11,13700	1,12200	3,35598	72
TAX	0,13330	0,15000	0,10000	0,02374	72

Source: author's

## 4. RESULTS AND DISCUSSION

In this section of the study, the authors initially present the results of unit root tests to establish stationarity, then conduct a variance inflation factors test to establish the absence of multicollinearity, while in the rest they indicate the main findings of this research. In table no. 3 shows the results of conducted panel unit root tests such as Levin, Lin & Chu test, Im, Pesaran & Shin test, and Augmented Dickey-Fuller test. The presented coefficients and levels of statistical significance indicate the presence of stationarity of all used variables during the first differentiation.

**Table 3:** Unit root tests

Variables	Levin, Lin & Chu		Im, Pesaran & Shin		ADF	
	Level	1st diff	Level	1st diff	Level	1st diff
DEBT	0,35631 (0,6392)	-3,7066 (0,0001)	0,15142 (0,5602)	-5,3548 (0,0000)**	16,4087 (0,4248)	58,4055 (0,0000)**
GL	-0,51234 (0,3042)	-5,0101 (0,0000)**	-0,24845 (0,4019)	-4,2028 (0,0000)**	15,5223 (0,4868)	46,7632 (0,0001)**
ROA	-1,2451 (0,1065)	-4,7971 (0,0000)**	-2,1266 (0,0167)**	-5,7327 (0,0000)**	28,9911 (0,0240)**	63,7589 (0,0000)**
SIZE	-0,4946 (0,3104)	-3,0390 (0,0012)**	2,2054 (0,9863)	-4,4494 (0,0000)**	10,3786 (0,1461)	49,0456 (0,0000)**
TAN	-1,2343 (0,1085)	-3,1399 (0,0008)**	-2,1321 (0,0165)**	-5,9288 (0,0000)**	28,8648 (0,0249)**	63,8540 (0,0000)**
GDP	-5,3855 (0,0000)**	-9,2482 (0,0000)**	-3,6592 (0,0001)**	-8,6566 (0,0000)**	40,2506 (0,0007)**	91,4141 (0,0000)**
INF	1,6409 (0,9496)	-2,9464 (0,0016)**	0,6358 (0,7376)	-7,1170 (0,0000)**	8,0973 (0,9459)*	76,0638 (0,0000)**
TAX	-1,1726 (0,1205)	-11,8199 (0,0000)**	0,8843 (0,8117)	-3,38801 (0,0004)**	6,9014 (0,9751)	-8,58250 (0,0000)**

Source: author's

After establishing the stationarity of the data, a variance inflation factor test was conducted to check the presence of multicollinearity between the used independent variables. The average VIF indicator is 1.3895, which indicates the absence of multicollinearity because the average value is less than the threshold value of 10.

**Table 4:** Variance inflation factor

Variables	Centered Vif
GL	1,2809
ROA	1,0698
SIZE	1,0903
TAN	1,2518
GDP	1,0877
INF	1,9502
TAX	1,9957
AVERAGE VIF	1,3895

Source: author's

As mentioned earlier in the work methodology section, this work section will present the results obtained based on the application of static and dynamic models on the example of the crisis and post-crisis period. The results of the diagnostic heteroscedasticity test on the example of model 1 (crisis period) failed to reject the null hypothesis of homoscedasticity, so it was determined that the used panel data are homoscedastic, which further confirms the greater adequacy of the application of static models in this case. The next diagnostic test performed is the Hussmann test for the selection between fixed and random effects static models. The results indicated a greater adequacy of the random effects model. The results of the diagnostic tests are summarized in Table No. Under. Observing the results, a statistically significant and negative effect of the profitability and tangibility variables was determined. The growth of profitability and tangibility of assets by 1% causes a decrease in total debt by 0.808%, and 0.416% respectively. Analyzing the obtained results, it is noticeable that the effect of microeconomic factors is far more statistically significant than the included macroeconomic factors, similar to the findings of Ersoi (2022), Ranjan (2021), Mazanec (2023), Ilie & VasIU (2022), which lead us to the conclusion that it is necessary to include more macroeconomic factors for an even better understanding of the effects. Regarding microeconomic factors, the results are as expected and support the postulates of one of the main theories of capital structure, namely the "Pecking order theory". The negative effect of profitability tells us that companies in the manufacturing sector of Serbia rather decide to reinvest the money they earn at the end of the business year into business, which leads to increased use of their funds compared to borrowed funds. The negative influence of tangible assets further supports that conclusion because it shows that companies in the manufacturing sector of Serbia look to finance as many fixed assets as possible using their funds.

**Table 5:** Static and dynamic models

Variables	Model 1 (REM)	Model 2 (GLS)
GL	-0,002660 (0,3870)	-0,002424 (0,0178)**
ROA	-0,808407 (0,0016)**	-0,255867 (0,0287)**
SIZE	-0,107974 (0,6414)	-0,672532 (0,0000)**
TAN	-0,416830 (0,0110)**	-0,097484 (0,2186)
GDP	0,002494 (0,4249)	-0,003092 (0,3283)
INF	-0,001550 (0,5054)	-0,000118 (0,9453)
TAX	-0,741091 (0,5798)	-0,62201 (0,0912)*
C	-0,003514 (0,8548)	-0,005411 (0,4582)
R squared	0,4088	0,707
Probability	0,0028	0,0000

Source: author's

**Table 6:** Diagnostic tests

Model 1	
Heteroscedasticity Panel LR test	3,635595 (0,8884)
Hausmann test	0,0000 (1,0000)
Model 2	
Heteroscedasticity Panel LR test	67,25039 (0,0000)

Source: author's

In the case of model 2 (post-crisis period), the performed diagnostic test of heteroscedasticity managed to reject the null hypothesis of homoscedasticity, so the dynamic model was chosen as a more adequate model when interpreting the results. The Hausmann test was not performed, because the use of static models was already rejected by an earlier

diagnostic test. The results indicated a statistically significant and negative effect on liquidity, profitability, and the corporate tax rate, while a positive effect was shown for the company size variable. The effect of income tax is statistically significant at 10% significance, while the others are at 5% significance. A 1% increase in liquidity, profitability, and corporate tax rate predicts a decrease in total debt of 0.002%, 0.256%, and 0.622%, respectively. A 1% increase in company size causes a 0.672% increase in total debt. The results and conclusions are similar in the case of model 1 and the findings of Roman, Rusu & Ghita-Mitrescu (2017) and Milovanović, Bašić & Bubaš (2022), which shows a greater commitment of the manufacturing sector in retaining and reinvesting own funds about debt. What is interesting is the statistically significant effect of the macroeconomic variable tax on company profits. The negative effect supports the conclusions of another theory of capital structure, namely the "Trade" theory, which tells us that companies use debt as long as it is the most profitable in terms of the obligation to pay taxes. The negative effect of the tax on short-term indebtedness tells us that when the profit tax increases, companies look to reduce the level of their short-term indebtedness in order to use their own funds more efficiently. Through the segmentation of the research period into crisis and post-crisis periods, certain differences in the findings were observed, while the postulates of the "Pecking order" and "Trade-off" theories were confirmed. Liquidity did not show a statistically significant effect in the crisis period, while the profitability and tangibility of assets had a more significant effect on the decline in the total indebtedness of companies in the crisis period compared to the post-crisis period. The sources tell us that during the crisis period, the reinvestment of profits in the company itself, be it in fixed assets or short-term assets, reduces the level of debt to a greater extent compared to the post-crisis period. Also, the impact of income tax was significant in the post-crisis period.

## 5. CONCLUSION

In conclusion, this study dealt with the intricate relationship between various microeconomic and macroeconomic factors and their impact on the overall debt level of manufacturing companies listed on the Serbian Stock Exchange. A statistically significant and negative impact of profitability and tangibility variables was found in the case of model 1. Total debt decreased by 0.808% and 0.416%, respectively, as a result of a 1% increase in profitability and asset tangibility. In Model 2, a 1% increase in the corporate tax rate, profitability, and liquidity was expected to result in a decrease in total debt of 0.622%, 0.256%, and 0.002%, respectively. Total debt increased by 0.672% for every 1% increase in company size. Certain deviations in the results were observed when the research period was divided into crisis and post-crisis periods and the principles of the "Pecking order" and "Trade-off" hypotheses were confirmed. While the profitability and tangibility of assets had a more significant and stronger impact on the decline in total corporate indebtedness in the crisis period compared to the post-crisis period, liquidity did not have a statistically significant effect in the crisis period. Sources inform us that, compared to the post-crisis period, the amount of debt is reduced more when profits are reinvested in the company, be it permanent or short-term assets. In addition, income taxes have had a major impact in the post-crisis years. These findings provide valuable insights to policymakers, investors, and corporate stakeholders seeking to navigate the complexities of financial decision-making in the manufacturing sector. Going forward, further research can delve deeper into specific industry segments or explore the implications of regulatory frameworks on debt dynamics, contributing to a more comprehensive understanding of financial dynamics within the Serbian manufacturing sector. Further limitations of the study include the use of only 8 companies in the sample and the survey of the manufacturing sector of one country. A proposal for future research is research into the manufacturing sector of several countries for comparative analysis, as well as the inclusion of a larger number of companies in the sample.

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### **Suzana Cvijanović**

Faculty of Business Economics, Bijeljina  
 University of East Sarajevo  
 Bijeljina, Republic of Srpska, BiH  
 e-mail: suzika.stevanovic@gmail.com

### **Vitomir Starčević**

Faculty of Business Economics, Bijeljina  
 University of East Sarajevo  
 Bijeljina, Republic of Srpska, BiH  
 e-mail: vitomir.starcevic@fpe.ues.rs.ba

## **ANALYSIS OF THE BREAK-EVEN POINT IN SELECTED COMPANIES IN CRISIS CIRCUMSTANCES**

**Abstract:** The research is based on the break-even analysis. The sample consists of three selected companies in the Republic of Srpska, whose financial reports are publicly published on the Banja Luka Stock Exchange website. The analysis covers the period from 2018 to 2022. The aim is to examine how companies operated and covered fixed costs during a period characterized by increased levels of uncertainty, risk, and challenges. Therefore, it is necessary to determine the break-even point (BEP-break-even point) for each year individually in each of the three companies, to determine the financial performance of the company in the crisis period. The obtained results indicate that the companies performed positively in the entire analyzed period, but worse financial performance was observed in the period 2020-2024 in all three companies.

**Keywords:** break-even point, rate of contribution margin, Republic of Srpska, crisis period.

### **1. INTRODUCTION**

In the Republic of Srpska, in addition to thermal power plants, hydroelectric power plants have significant importance in electricity production and play a crucial role in the country's energy sector. However, due to exposure to dynamic economic and environmental situations, hydroelectric power plants face various challenges and crises that can affect the overall efficiency of their existence. Based on this, the subject of this research will be focused on analyzing the breakeven point of profitability of hydroelectric power plants in the Republic of Srpska during crisis periods. The aim is to examine how the breakeven point of profitability in hydroelectric power plants for the period 2018-2022 behaves under conditions of increased instability and uncertainty in business. This research can serve as a starting point for the development of effective management strategies and policies to maintain stability and sustainability in the energy sector of the Republic of Srpska.

The paper is divided into four parts. The first part presents a literature review, which includes research that deals with the analysis of the break-even point of profitability in a company. The second part of the paper presents the methodological framework of the research, as well as a description of the sample. The third part represents the analysis of the break-even point of profitability on a sample of three companies in the Republic of Srpska for the period 2018-2022. The fourth part provides concluding remarks.

### **2. LITERATURE REVIEW**

In the study by Rizki & Sukoco (2019, February), a break-even analysis was applied to a group of small and medium enterprises in Indonesia. A qualitative research method was applied through a case study, and a quantitative method through calculating the break-even point using the contribution margin. The results showed that the break-even point of profitability was achieved after 7 months and 3 days. Additionally, authors Arfianti & Reswanda (2020) examined the break-even point of profitability of the batik writing center 'Reliable Insan Sentosa'. This center has been a guardian of

the tradition and artistic value of Indonesian culture for many years. In this research, the author utilized qualitative descriptive analysis as well as quantitative analysis by calculating the break-even point and safety margin to determine the financial status of this center. The results display the break-even point of profitability and safety margin for the mentioned center.

Jamaludin (2020) analyzed the break-even point of profitability in Indonesia using the example of one company's balance sheet for the year 2018. This analysis aimed to determine the financial capability of the company, which could serve as a basis for decision-making within the company. The research method involved visiting the company and conducting interviews, as well as descriptive analysis of the balance sheet, profit and loss statement, and sales data of the company. Khanifah & Septiana (2019) drew conclusions based on the break-even point of profitability and safety margin analysis using the balance sheet of the company 'Berkah Jaya'. The research results for the year 2016 showed that the mentioned company can generate a profit and efficiently conduct its activities. Through the obtained safety margin, it was concluded that this company has a higher level of risk protection and a lower risk of losses. Based on the analysis of unit costs and break-even analysis for the restaurant 'Bistro RHA', authors Angsoka & Aliludin (2020) identified and classified all unit costs and calculated the break-even point for each product. The results of this study indicate that all products have successfully reached the break-even point, and this analysis can serve as a basis for decision-making for the company in the future. The break-even point analysis of profitability is a valuable tool in the agricultural sector, so Syřůček, Bartoř, and Burdych (2022) conducted a study on the break-even point analysis of profitability in the Czech Republic and the European Union. This analysis was conducted due to unstable conditions in the milk markets of these countries. The research results revealed significant differences between the Czech Republic, selected EU countries, and the EU average regarding the break-even point for milk yield and price. These differences stem from substantial variations in total costs and milk yields. Utami and Mubarok (2021) emphasize the importance of understanding fixed and variable costs to accurately assess the scope of production and sales, which will ultimately result in a certain profit. In other words, knowing these costs enables companies to plan their activities based on realistic expectations. Through break-even point analysis, it is possible to assess these cost categories and determine the optimal sales volume to avoid potential losses. This approach enables companies to make informed decisions and allocate their resources where they will have the greatest impact on profitability.

### **3. RESEARCH APPROACH AND METHODOLOGY**

The analysis of the break-even point of profitability was conducted through descriptive analysis and by calculating the marginal or contribution profit rate. The sample consists of three companies from the Republic of Srpska, whose financial reports are publicly available on the Banja Luka Stock Exchange. The following companies were included in the research: 'Hidroelektrana na Drini' A.D. Trebinje, 'ERS' MP Mixed Holding A.D. Hidroelektrana na Trebiřnjici, and ZP 'Hidroelektrane na Vrbasu' A.D. Mrkonjić Grad.

The analysis spans the period from 2018 to 2022, notably marked by the global COVID-19 pandemic, as well as the recent crisis initiated by unrest and conflict between Ukraine and Russia. These significant events have had far-reaching effects worldwide, prompting economic turbulence and uncertainty across various sectors. The data were collected from the financial statements of the mentioned hydroelectric power plants for the period from 2018 to 2022, sourced from the website of the Banja Luka Stock Exchange.

The reason for choosing this sample is that hydroelectric power plants worldwide play a crucial role in the energy mix, providing sustainable energy sources and promoting social responsibility. Considering that hydroelectric power plants typically have stable long-term prospects, especially during periods of economic instability and crises, the author intended to analyze their break-even point of profitability. The aim was to demonstrate how sustainable and profitable hydroelectric power plants are even in crisis circumstances. Additionally, the availability of detailed data on the website of the Banja Luka Stock Exchange further facilitated the analysis of these companies.

The analysis of the break-even point of profitability proceeded in the following manner: Firstly, total costs were segmented into fixed costs, which remained constant, and predominantly fixed costs, along with variable costs for each company and each year under scrutiny. Subsequently, the contribution profit rate was computed for each company across the entire duration of the analysis. Finally, the break-even point of profitability was determined for all companies throughout the entire analysis period, utilizing the contribution profit rate.

### **4. THE CONCEPT OF BREAK-EVEN POINT ANALYSIS**

The break-even point represents the lower threshold of profitability, the point at which financial result equals zero. When the financial result is zero, it is said to be neutral, as the company's revenues are equal to its expenses. Therefore, this is the boundary for exiting the loss zone for the company (Maleřević & Starčević, 2010). Break-even point analysis determines the production level at which the company neither incurs losses nor earns profits. Thus, this approach identifies the sales level that the company needs to achieve to reach this break-even point (Tsorakidis, Papadoulus,

Zerres, & Zerres, 2014). This analysis can assist the company in choosing various alternatives to achieve maximum profit (Khanifah & Septiana, 2019).

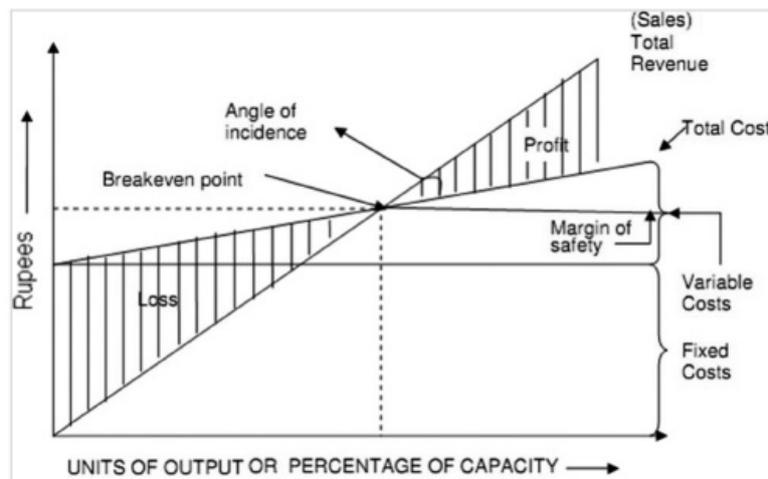


Figure 1. Break-even point  
Source: (Kampf, Majerčák, & Švagr, 2016, p. 127)

The concept of this analysis relies on the theory of marginal costs. According to this, there is a necessity to divide total production or service costs into fixed and variable costs. Fixed costs remain constant at the same level of production volume, while variable costs change with changes in production volume (Ndaliman & Bala, 2007). The purpose of this analysis is to assist in human resource management and aid in decisions regarding whether to allocate resources to planned investments and projects or not (Ndaliman & Suleiman, November 2011). Therefore, when the break-even point is determined, it can serve as a useful tool for predicting when a specific project or investment will yield a positive return (Kampf, Majerčák, & Švagr, 2016). The break-even point can also be graphically represented (Figure 1).

## 5. ANALYSIS OF THE BREAK-EVEN POINT OF PROFITABILITY IN SELECTED COMPANIES IN THE REPUBLIC OF SRPSKA

For this analysis, data were collected from the financial reports of selected companies in the Republic of Srpska, namely: 'Hidroelektrana na Drini' A.D. Trebinje, 'ERS' MP Mixed Holding A.D. Hidroelektrana na Trebišnjici, and ZP 'Hidroelektrane na Vrbasu' A.D. Mrkonjić Grad. The financial reports of these companies are publicly available on the website of the Banja Luka Stock Exchange (Banja Luka Stock Exchange, 2024), and the analysis was conducted for the period 2018-2022.

### 4.1. Cost categorization

Based on the income statements of selected companies for the period 2018-2022, total company expenses were divided into fixed and predominantly fixed costs and variable costs.

**Table 1.** Cost breakdown in BAM (Convertible Marks) for the company HEDR (2018-2022)

	2018	2019	2020	2021	2022
Total costs	31.108.184	30.118.961	28.111.412	32.728.814	33.725.903
Variable costs	21.188.517	19.325.173	17.967.505	21.384.596	21.867.301
Fixed and predominantly fixed costs	9.919.667	10.793.788	10.143.907	11.344.218	11.858.602

**Source:** Author based on data from the financial reports of the company "Hidroelektrana na Drini" A.D. Trebinje, for the period 2018-2022.

\*Note: HEDR - "Hidroelektrana na Drini" A.D. Trebinje.

According to the presented Table 1, it can be observed that in the company HEDR for the period 2018-2022, variable costs have the highest share in the category of total expenses. Additionally, variations in the movement of total costs are noted, with a tendency to increase until the end of 2022. In the structure of total costs during the analyzed period, there is an increase in the share of fixed and predominantly fixed costs.

**Table 2.** Cost breakdown in BAM (Convertible Marks) for the company HELV (2018-2022)

	2018	2019	2020	2021	2022
Total costs	15.083.382	15.919.685	14.689.030	16.152.925	16.519.637
Variable costs	4.531.463	4.798.696	3.660.520	5.001.468	6.211.442
Fixed and predominantly fixed costs	10.561.919	11.120.989	11.028.510	11.151.457	10.308.195

**Source:** Author based on data from the financial reports of the company "Hidroelektrana na Vrbasu" A.D., for the period 2018-2022.  
\*Note: HELV - "Hidroelektrana na Vrbasu" A.D.

In the case of the company HELV, during the period 2018-2022, there is a trend of increasing total costs. Additionally, fixed and predominantly fixed costs have a higher share in the structure of total costs, but in the last year, there has been a notable increase in variable costs compared to fixed and predominantly fixed costs.

**Table 3.** Cost breakdown in BAM (Convertible Marks) for the company HETR (2018-2022)

	2018	2019	2020	2021	2022
Total costs	59.970.555	51.368.185	49.883.587	53.839.422	64.484.404
Variable costs	20.465.926	6.740.833	8.840.374	11.629.359	18.500.615
Fixed and predominantly fixed costs	39.504.629	44.627.352	41.043.213	42.210.063	45.983.789

**Source:** Author based on data from the financial reports of the company "Hidroelektrana na Trebišnjici" A.D., for the period 2018-2022.  
\*Note: HETR - "Hidroelektrana na Trebišnjici" A.D.

For the company HETR, during the period 2018-2022, there was a notable increase in total costs, particularly highlighted in 2022. In the structure of total costs, fixed and predominantly fixed costs have the largest share. Variable costs have fluctuated in amount during the analyzed period, showing a decreasing trend, while fixed and predominantly fixed costs have experienced a rising trend with slight fluctuations throughout 2018-2022.

## 4.2. Marginal profit rate and break-even point

The marginal profit rate is calculated according to the following formula (Malešević & Starčević, 2010):

$$1 - \text{Variable costs} / \text{Sales revenue}$$

By calculating this rate, information is obtained about how much additional pre-tax revenue helps the company's profit and covers fixed costs after covering variable costs. The higher the rate, the greater the management's confidence in achieving set goals.

**Table 4.** Marginal profit rate in selected companies in % (2018-2022)

	2018	2019	2020	2021	2022
HEDR	45,4	45,4	23,0	45,4	39,67
HELV	73,02	76,54	73,48	74,01	71,82
HETR	69,2	81,81	80,41	79,76	79,5

**Source:** Author's calculation.

In the first observed company, HEDR, for the period 2018-2022, the lowest contribution profit rate was recorded in 2020 at 23%, with an increase in the following year to 45.4%. However, in 2022, there is a slight decline in the marginal profit rate from 45.4% to 39.67%.

In the company HELV, for the period 2018-2022, there are fluctuations in the movement of the marginal profit rate. The highest rate is observed in 2019 at 76.54%, and the lowest in the last analyzed year, 2022, at 71.82%.

The marginal profit rate in the company HETR was lowest in 2018 at 69.2% and highest in 2019 at 81.81%. There has been a downward trend in this rate by the end of the analyzed period.

In all three analyzed companies, the marginal profit rate increased in 2021 compared to 2020, except for the HETR company. In 2022, there was a decrease in the marginal profit rate in all three analyzed companies.

**Table 5.** Break-even point in selected companies in BAM (Convertible Marks) (2018-2022)

	2018	2019	2020	2021	2022
HEDR	21,849,486.78	23,774,863.43	44,103,943.47	24,987,264.31	29,893,123.26
HELV	14,464,419.33	14,529,643.32	15,008,859.55	15,067,500.33	14,352,819.54
HETR	57,087,614.16	54,549,996.33	51,042,423.82	52,921,342.77	57,841,244.02

Source: Author's calculation.

The break-even point represents the lower threshold of profitability, necessary for achieving a zero business result. The break-even point is obtained through the relationship between fixed and predominantly fixed costs and the calculated marginal profit rate (Malešević & Starčević, 2010).

According to the obtained results, in the company HEDR, the highest revenue to achieve a zero business result was in 2020, amounting to 44,103,943.47 KM, while the lowest was in 2018, at 21,849,486.78 KM. For the company HELV, the break-even point did not fluctuate much, but it can be observed that it was lower in 2022 compared to 2021, meanwhile, in the case of the break-even point for the company HETR, the highest amount was recorded in the last year, 2022, at 57,841,244.02 KM.

## CONCLUSION

The results of the break-even point analysis for the period 2018-2022, based on the financial statements of the companies: "Hidroelektrana na Drini" A.D. Trebinje (HEDR), "ERS" MP Mixed Holding A.D. Hidroelektrana na Trebišnjici (HETR), and ZP "Hidroelektrane na Vrbasu" A.D. Mrkonjić Grad (HELV) indicate a slight decline in activity in all three observed companies in 2020 and again in 2022. The contribution profit margin in the HEDR company fluctuated, with the lowest recorded in 2020 at 23%. In the HETR company, the marginal profit rate was lowest in the first year of 2018 at 69.2%, while in the HELV company, the lowest rate was in 2022 at 71.82%. However, when interpreting the contribution profit rate, consideration should also be given to the structure of total costs and the management's set goals. According to the break-even point analysis, it can be concluded that the analyzed companies faced minor difficulties in business operations since 2020, but the achieved profit exceeded the break-even point. In the last year of 2022, a decline in business results is observed in all three companies, as the increase in total costs has caught up with the increase in total revenues.

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### **Milica Indić**

Faculty of Economics Subotica, University of  
 Novi Sad  
 Subotica, Serbia  
 milica.indjic@ef.uns.ac.rs

### **Miloš Pjanić**

Faculty of Economics Subotica, University of  
 Novi Sad  
 Subotica, Serbia

### **Vera Mirović**

Faculty of Economics Subotica, University of  
 Novi Sad  
 Subotica, Serbia  
 vera.mirovic@ef.uns.ac.rs

### **Branimir Kalaš**

Faculty of Economics Subotica, University of  
 Novi Sad  
 Subotica, Serbia  
 branimir.kalas@ef.uns.ac.rs

## **MEASURING THE IMPACT OF GEOPOLITICAL RISK ON CAPITAL MARKET IN SELECTED DEVELOPED COUNTRIES**

**Abstract:** Shocks that cause uncertainty also inevitably have an impact on financial markets, in addition to the typical range of economic and financial considerations. Previous research shows that recent events like the COVID-19 pandemic, changes in oil prices, and the Russian-Ukrainian conflict have had an impact on the world financial market. The aim of the paper is to examine the impact of geopolitical risk on the capital markets of developed countries in the region of Asia and Oceania. The main research variables in the capital market are share trading and market capitalization. To measure the impact of geopolitical risk on capital market variables, in the period from 2005 to 2022, a panel regression analysis was applied. The observation period includes three major events that had a strong impact on the global capital markets, namely the global financial crisis, COVID-19, and the Russian-Ukrainian conflict. According to the findings, stock trading is negatively impacted, while market capitalization is positively impacted by geopolitical risk. Both influences are not significant. When making financial decisions, information about how the capital markets respond to geopolitical events can be helpful, especially for investors.

**Keywords:** Stock trading, Market capitalization, Country-specific geopolitical risk, Asia and Oceania, Panel regression

## **1. INTRODUCTION**

Geopolitical Risk (GPR), which refers to events that could disrupt the regular course of relations between states, has drawn the attention of academic scholars and policymakers due to the sharp increase in the frequency of unfavorable geopolitical events. It is widely held that geopolitical risk (GPR), since it includes risks related to terrorist attacks, wars, and conflicts between nations, has a significant role in influencing financial and macroeconomic cycles. Geopolitical risk is frequently mentioned as a factor in investment decisions by business investors and central bankers (Caldara and Iacoviello, 2018). Significant fluctuations in the price of gold, crude oil, and stock markets have been caused by recent geopolitical tensions (Qian et al., 2022). Consequently, the main factor influencing the state of the global financial system is now geopolitical risk rather than economic risk (Shaik et al., 2023). Understanding geopolitical risk's economic impact is crucial because of its growing relevance, which is a result of both modern globalization and technological advancements, as well as the fact that it lacks an economic foundation and has a weak correlation with other sources of macroeconomic and financial instability (Fiorillo et al., 2024).

According to Bohl et al. (2017), geopolitical risks are trends in political and economic changes that have the potential to be harmful to human well-being. Authors further argue that these risks are caused by three interrelated risks: 1) political risks stemming from power struggles among geopolitical actors, which can take many forms but most intensely manifest as violent conflict; 2) economic risks resulting from regional or global financial and economic unrest; and 3) natural risks resulting from changes in the environment that are not caused by humans, such as droughts brought on by climate change. There's a way to do more focused quantitative research on how geopolitical risks affect financial

markets, thanks to the geopolitical risk index developed by Caldara and Iacoviello (2022). According to Caldara and Iacoviello (2018), economic agents including entrepreneurs, market participants, and central bank officials rely heavily on geopolitical risks when making judgments on investments and stock market movements. They discover that rising geopolitical risk causes movements in capital flows away from developing and toward developed nations, as well as a decline in actual economic activity and stock returns. Nonetheless, depending on certain volatility regimes, times, etc., some prior empirical research supports the positive or negative major benefits of the GPR index on stock market outcomes. Additionally, Bouras et al. (2019) confirm that neither the global nor the country-specific GPRs affect stock returns for emerging economies, and that the global GPR has a positive and statistically greater effect on stock market volatility than country-specific GPRs. Research by Rawat and Arif (2018) shows that compared to Indian and Chinese funds, Brazilian and Russian funds respond more quickly to geopolitical shocks peculiar to their respective nations. According to Hoque et al. (2019), there is no direct influence of geopolitical risk on the Malaysian stock market; nevertheless, there are notable indirect effects that are conveyed through the channels of oil shocks and uncertainty in global economic policy. Based on results of their study, Hoque and Zaidi (2020), with the exception of India, the impacts of both risk factors on stock market returns are asymmetric, and the country-specific GPR has a negative impact on stock market returns.

Previous research has demonstrated that risks, shocks, and geopolitical turbulence have an effect on financial markets and economic activity (De Wet, 2023; Lai et al., 2023). Long-term geopolitical tensions slow down economic activity and, depending on their severity, may cause individual economies and the global economy to contract, according to empirical findings from a number of studies (Bloom, 2009; Caldara & Iacoviello, 2022). The negative effects on investment, employment, and downside risks (Caldara & Iacoviello, 2022), equity returns and bond spreads (Rigobon & Sack, 2005), and stock market volatility (Choi, 2022) are evidence from studies that suggest GPR has significant impacts on corporations and financial markets. According to a recent study by Salisu et al. (2022), stock returns are more negatively impacted by geopolitical threats (such as military build-ups, acts of terrorism, and war threats) than by geopolitical acts (i.e., the actual occurrence of bad events). Russia-Ukraine war conflict, in 2022, is seen as a major increase in geopolitical dangers as part of a revived geopolitical battle among the world's big powers. Robin et al. (1996) investigate how political risk affects both developed and emerging economies. It was discovered that, in comparison to emerging markets with higher political risk, those with lesser political risk had average returns that were about 11% higher in a quarter. In contrast, for the developed markets, the differential is only 2.5% on a quarterly basis. Dimic et al. (2015) looked into the relationship between political risk factors and stock returns in frontier, emerging, and developed markets. All three stock market categories take composite political risk into account, although the impact of each component varies between markets. Balcilar et al. (2018) examined the effect of geopolitical risk on yield dynamics and volatility in the stock markets of BRICS countries. The effect of geopolitical risks is heterogeneous, which implies that news about geopolitical tensions does not affect yield dynamics in a uniform way. In addition, according to the findings of the study by the mentioned authors, geopolitical risk affects stock market volatility measures.

This article measures the effect of geopolitical risk on developed countries in Asia and Oceania, specifically Australia, China, Hong Kong, Japan, and North Korea, taking into account the topic's current relevance. The study aims to ascertain how geopolitical risk affects stock trading and market capitalization in these countries between 2005 and 2022. Three significant events that had a significant impact on the world's capital markets occurred during the observation period: the global financial crisis, COVID-19, and the Russian-Ukrainian conflict. The introduction appears in the opening section of the paper. The following is the design of the remaining portions of this paper: The research methodology is covered in the second part. The analysis's findings and a discussion of them are provided in the third part. Conclusions and implications are presented in the final part.

## 2. RESEARCH METHODOLOGY

Data covering the years 2005 to 2022 was used to assess the effect of country-specific geopolitical risk on market capitalization and stock trading in developed nations in Asia and Oceania. Official websites provided the data (Table 1). Annual data is available on market capitalization and stock trading. Since country-specific geopolitical risk data is updated on a monthly basis, average values were utilized in the subsequent research. There have been ninety observations in total.

**Table 1:** Variables and data sources

Varijabla	Description	Izvor
Stock trading	Market capitalization of listed domestic companies (% of GDP), Annual data	The World Bank <a href="https://www.belex.rs/trgovanje/kapitalizacija">https://www.belex.rs/trgovanje/kapitalizacija</a>
Market capitalization	Stocks traded, total value (% of GDP), Annual data	The World Bank <a href="https://data.worldbank.org/indicator/CM.MKT.TRAD.GD.ZS">https://data.worldbank.org/indicator/CM.MKT.TRAD.GD.ZS</a>
Geopolitical risk	Country-specific geopolitical risk index, Monthly data	<a href="https://www.matteoiacoviello.com/gpr_country_files/gprc_as.htm">https://www.matteoiacoviello.com/gpr_country_files/gprc_as.htm</a>

Source: Authors

The variables analyzed in the research are classified as dependent variables, namely stock traded (ST) in the first analysis, market capitalization (MC) in the second analysis, and an independent variable, country-specific geopolitical risk (GPR). Table 2 shows the descriptive statistics of the sample. As per Jarque-Bera values, the data does not exhibit a normal distribution; therefore, logarithmic values (LST, LMC, and LGPR) were employed for further analysis.

**Table 2:** Descriptive statistics

	ST	MC	GPR
Mean	218.0833	293.4278	0.251713
Median	125.2000	95.05000	0.173750
Maximum	1102.700	1777.200	1.110000
Minimum	17.20000	17.60000	0.019167
Std. Dev.	228.8192	431.0377	0.230160
Skewness	1.959973	1.787001	1.588392
Kurtosis	6.175438	4.714245	5.373799
Jarque-Bera	95.43515	58.92046	58.97582
Probability	0.000000	0.000000	0.000000
Sum	19627.50	26408.50	22.65417
Sum Sq. Dev.	4659881	16535623	4.714660
Observations	90	90	90

Source: Authors

Panel data regression models (PDRM) serve as the basis for data analytics and research methodology. Econometric analysis begins with a review of several statistical model formulations, then moves on to a battery of tests to identify which model best fits the study data. The model's fundamental assumptions - specification model errors, multicollinearity, autocorrelation, and heteroscedasticity - are further tested using econometrics diagnostic tests. Strictly balanced datasets, or "full" time series, are used in the analysis. The least-squares model (POLS), fixed-effect model (FE), and random-effect model (RE) were used for testing.

### 3. EMPIRICAL RESULTS AND DISCUSSION

For the unit root problem in this work, Im et al. (2003), Levin et al. (2002), and the ADF and PP Fisher chi-square tests recommended by Maddala and Wu (1999) were used. The null hypothesis, according to the results of the four stationarity tests shown in Table 3, is refuted by the data. As a result, it can be concluded that variables in the study (LST and LMC), including the first differential of the variable LGPR, are stationary at level. Table 3 also includes the results of the variance inflation factor (VIF) test. Belsley et al. (1980) state that a VIF of less than 10 indicates that there is no multicollinearity problem. Based on the VIF results, it can be concluded that there is no multicollinearity issue with the data.

**Table 3:** VIF and panel unit root tests

Variable	VIF	Panel unit root tests			
		Levin, Lin, and Chu	Im, Pesaran, and Shin	PP - Fisher chi-square	ADF - Fisher chi-square
LST	-	-2.06***	-2.19**	24.79***	20.629***
LMC	-	-2.58 ***	-2.89***	40.123***	28.085***
LGPR_D	1.08	-5.16***	-3.98***	44.789***	33.941***

Note: \*\*\* - significance at 1%.

Source: Authors

The results of the analysis indicate that the POLS and RE model are not at a statistically significant level ( $\text{Prob}(F\text{-statistic}) > 0.05$ ), while the FE model is statistically significant ( $\text{Prob}(F\text{-statistic}) < 0.05$ ) (Table 4). The coefficient of determination (R square) is, in the model with fixed effects, about 81% of the variation of the dependent variable (stock trading) is explained on the basis of the independent variable (country-specific geopolitical risk). To determine if the model is well-specified, the Ramsey RESET test was employed. The improved results ( $F(1, 86) = 0.018$ ;  $\text{Prob} > F = 0.8936$ ) show that there were no important factors omitted from the model. The next phase involved searching the model for serial correlation issues using the Pasaran CD test. The absence of serial correlation is the null hypothesis. Given that the test's statistical significance is greater than 0.05 ( $p = 0.4306$ ), the null hypothesis—which holds that there is no serial correlation—can be accepted. Model's heteroscedasticity was tested using White's test. The null hypothesis cannot be rejected if the  $\chi^2$  statistic probability generated by this test is greater than the error risk  $\alpha$  ( $\alpha = 5\%$ ). The

homoscedasticity errors in the model are confirmed by the probability value of chi statistics in this test, which is 0.5218. With an error risk of 5%, we are unable to reject the null hypothesis.

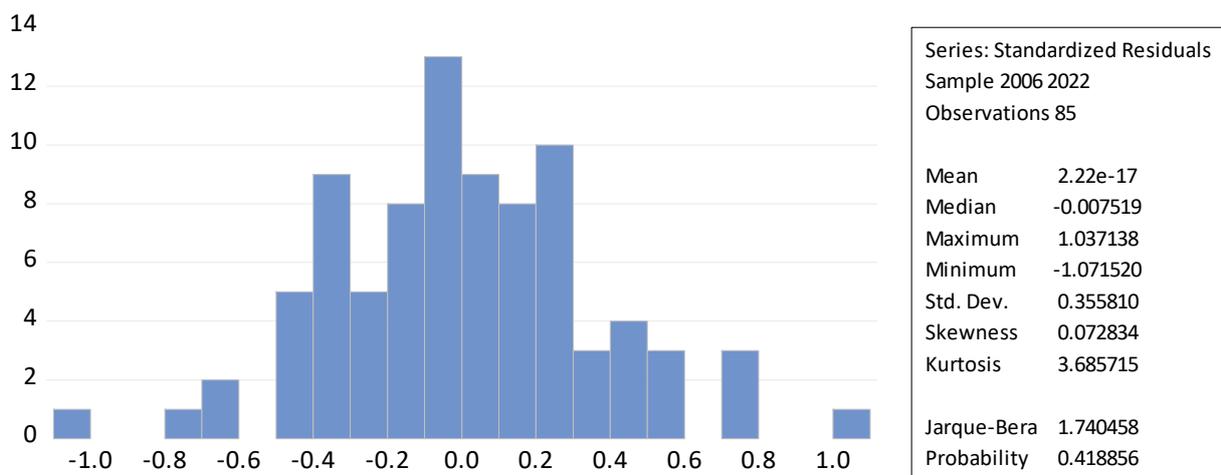
The results of the FE model show that stock trading is negatively but not significantly related to country specific geopolitical risk. Similarly, Bounou & Yatié (2022) found a negative link between the war in Ukraine and returns on global stock markets based on data on daily stock market returns on a sample of 94 countries for the period from 01/22/2022. – 03/24/2022. The study's findings, according to the cited authors, point to a higher impact early in the war, particularly in the first two weeks following 02/24/2022, or when the combat officially began. The subsequent weeks saw a lessening of the response from the world's stock markets. Furthermore, the results of the previously mentioned study suggest that these effects were particularly noticeable for nations that bordered Russia and Ukraine as well as for UN members that called for a halt to the war conflict. The influence of the Russian-Ukrainian military conflict on the G7 stock markets was studied by Abbassi et al. (2023), and their findings show that the conflict had varied effects on different markets. Over the course of the study period, companies in Germany, Italy, and the UK saw negative cumulative returns, while those in Canada and Italy demonstrated positive cumulative impacts. Conversely, the battle had negligible impact on American and French businesses.

**Table 4:** FE model results

LST	Coef.	Srd. Err.	t	p
LGPR_D	-0.127620	0.112454	-1.134866	0.2599
Cons.	5.038122	0.040171	125.4167	0.0000
<b>Diagnostic tests</b>				
Ramsey RESET test	t (86) = 0.134, p = 0.8936; F (1,86) = 0.018, p = 0.8936; Likelihood ratio (1) = 0.0186, p = 0.8915			
Pesaran CD	Statistic = 0.788191, p = 0.4306			
White test	Obs*R-squared = 1.300776; Prob. Chi-Square(2) = 0.5218			

Source: Authors

Based on the Jarque-Bera test result of 1.74 with p = 0.42, the results of testing for residual normality (Figure 1) indicate that the residuals have a normal distribution.



**Figure 1:** Test for residual normality  
Source: Authors

The results of the analysis indicate that the POLS and RE models are not at a statistically significant level (Prob(F-statistic) > 0.05), while the FE model is statistically significant (Prob(F-statistic) < 0.05) (Table 5). The coefficient of determination (R square) is that in a model with fixed effects, about 94% of the variation of the dependent variable (market capitalization) is explained on the basis of the independent variable (country-specific geopolitical risk). To determine if the model is well-specified, the Ramsey RESET test was employed. The improved results (F(1, 86) = 1.221; Prob > F = 0.2723) show that there were no important factors omitted from the model. The next phase involved searching the model for serial correlation issues using the Pasaran CD test. Given that the test's statistical significance is greater than 0.05 (p = 0.6801), there is no serial correlation. Model's heteroscedasticity was tested using White's test. The homoscedasticity errors in the model are confirmed by the probability value of chi statistics in this test, which is 0.7460.

The results of the FE model show that market capitalization is positively, but not significantly, related to country-specific geopolitical risk. Similarly, Hassan et al. (2022) used a sample of six events resulting from Indian border disputes in 2020 to demonstrate the varied impacts of two categories of events. The findings demonstrated that the sector indexes responded to both events in a varied manner. Certain industries had both positive and negative atypical returns, while others were untouched by the circumstances. Sidhu & Suri (2022) assessed how the war between Russia and Ukraine affected the performance of the 20 biggest Indian firms that were listed on the domestic stock market. The

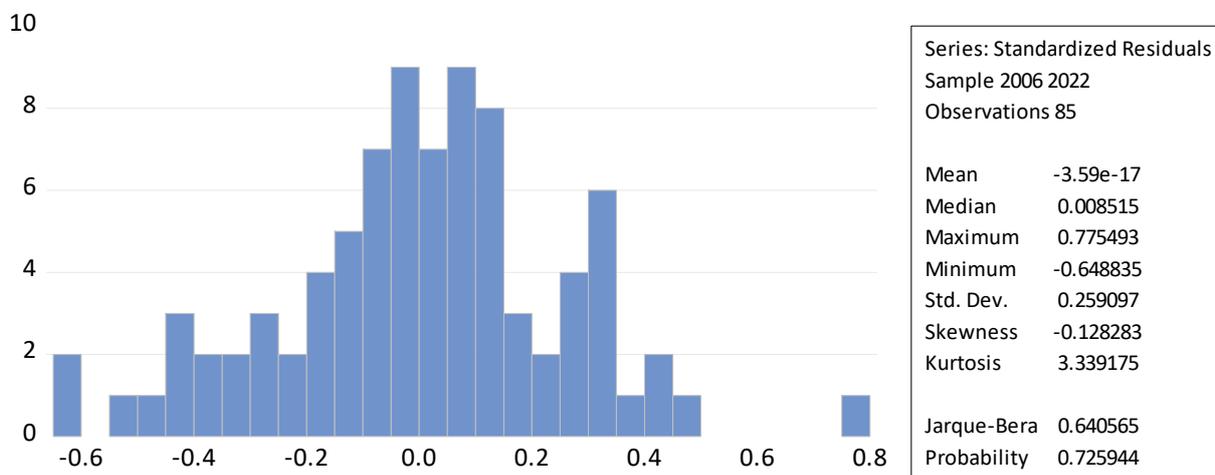
findings showed that following the performance drop, there was a trend of improvement in the first two weeks following the start of the war conflict. The effect of exchange rate fluctuations, economic policy uncertainty, and geopolitical risk on the South Korean stock market was measured by Adebayo et al. (2022) during the years 1997–2021. The study's findings demonstrated the uneven and erratic impact of macroeconomic shocks on the South Korean stock market. The findings demonstrated that while the exchange rate has a causal impact on the stock market that is only evident in the mean value and does not show any evidence of causality in the variance, geopolitical risk and economic policy uncertainty have a causal influence on the stock market that is visible in both the mean value and the variance.

**Table 5:** FE model results

LMC	Coef.	Srd. Err.	t	p
LGPR_D	0.093181	0.081888	1.137913	0.2586
Cons.	4.949389	0.029252	169.1971	0.0000
<b>Diagnostic tests</b>				
Ramsey RESET test	t (86) = 1.1048, p = 0.2723; F (1,86) = 1.221, p = 0.2723; Likelihood ratio (1) = 1.2542, p = 0.2627			
Pesaran CD	Statistic = -0.412365, p = 0.6801			
White test	Obs*R-squared = 0.586134; Prob. Chi-Square(2) = 0.7460			

Source: Authors

Based on the Jarque-Bera test result of 0.64 with  $p = 0.73$ , the results of testing for residual normality (Figure 2) indicate that the residuals have a normal distribution.



**Figure 2:** Test for residual normality  
Source: Authors

## 4. CONCLUSION

The aim of the research, within this paper, was to determine the impact of geopolitical risk on stock trading and market capitalization in developed countries of the Asia and Oceania region (Australia, China, Hong Kong, Japan and South Korea). The obtained results indicated a negative impact of geopolitical risk on stock trading, while the impact on market capitalization was positive. However, both effects are insignificant.

In general, the effects of geopolitical risk on financial volatility have not yet been sufficiently explored. Increasing research on this topic is, therefore, one of the key implications of this work. Consequently, by analyzing the responses of Asian and Oceanian stock markets to the global financial crisis, Covid-19 pandemic, and the Russia-Ukraine crisis, this study adds to the body of literature. On the other hand, as a supplement to existing knowledge, investors in particular can benefit from knowing how the capital markets react to geopolitical events when making financial decisions. This helps to boost the efficacy of hedging techniques in addition to portfolio diversification.

Following the paper, some restrictions are placed on the task; these restrictions might also serve as suggestions for additional research on the subject. Specifically, country-specific risk, market capitalization, and stock trading were the three indicators used in this research. In light of this, additional indicators from both developed and developing countries, such as stock market returns or global geopolitical risk, may be incorporated into future studies. Furthermore, examining the impact of geopolitical risk alone on developed country capital markets could mislead researchers into believing that these markets respond poorly to geopolitical developments. For this reason, volatility may be incorporated into a variety of econometric models in future studies. Furthermore, there are always additional variables, such as concurrent political developments, that were not covered in this research. Specifically, the patterns of share prices and stock market indices are the result of all concurrent events, and these elements may be considered in

subsequent research. In addition, future studies might look at which developed-country markets are the primary risk transmitters and how geopolitical risk contributes to the process of bringing instability to those markets. Geopolitical shocks, especially terrorist incidents, are usually unpredictable. However, an open economy, which allows local investors to diversify their country-specific risks in their portfolios, as well as a strong financial sector, can help restore financial market stability.

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# Session

## 6

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**Ferenc Kiss**  
Faculty of Technology Novi Sad  
Novi Sad, Serbia  
e-mail: fkiss@uns.ac.rs

**Reka Korhecz**  
Faculty of Economics in Subotica  
Subotica, Serbia  
e-mail: reka.korhecz@ef.uns.ac.rs

## **ASSESSING THE CARBON FOOTPRINT AND CUMULATIVE ENERGY DEMAND OF BIODIESEL PRODUCED FROM RAPESEED OIL IN SERBIA**

**Abstract:** This paper aims to evaluate the carbon footprint and energy balance associated with biodiesel production from rapeseed in Serbia, employing the life cycle assessment (LCA) methodology. Data on material and energy consumption were collected for the primary agricultural and industrial entities involved in the biodiesel production chain, with the broader system modeled using information from the ecoinvent life cycle inventory database. Our findings indicate that the carbon footprint of biodiesel (44 g CO<sub>2eq</sub>/MJ) is significantly lower than that of fossil diesel (86 g CO<sub>2eq</sub>/MJ) when not considering the potential impacts of indirect land-use change (iLUC). However, inclusion of iLUC impacts could result in a higher carbon footprint for biodiesel than fossil diesel. The life-cycle fossil energy inputs for rapeseed biodiesel are estimated at 0.53 MJ per one MJ of biodiesel, while fossil diesel requires approximately 30% more fossil energy than is present in the fuel.

**Keywords:** biodiesel, rapeseed, carbon footprint, energy efficiency, life cycle assessment.

### **1. INTRODUCTION**

Biofuels are being advocated as environmentally friendly substitutes for fossil fuels because they derive from renewable biomass sources. Unlike fossil fuels, the carbon dioxide released when biofuels are burned is considered neutral for global warming because it originates from the atmosphere, having been absorbed by plants during photosynthesis. However, the production chain of biofuels involves various processes that emit greenhouse gases (GHGs) and consume non-renewable energy sources. Therefore, to accurately assess the environmental impact of biodiesel, it's crucial to adopt a life cycle approach, encompassing every stage in its complex life cycle from resource extraction to final combustion. The life cycle assessment (LCA), outlined in ISO 14040 and ISO 14044 standards, is a standardized environmental management tool recommended by the European Commission and mandated by the Directive of the European Parliament and Council (EU) 2018/2001, also known as the Renewable Energy Directive 2018. This methodology offers a systematic framework for evaluating the environmental footprint of products, including biofuels, ensuring that all associated impacts are thoroughly considered. By employing LCA, policymakers and stakeholders can gain a holistic understanding of the environmental implications of biofuel production and use, enabling informed decision-making towards sustainable energy solutions.

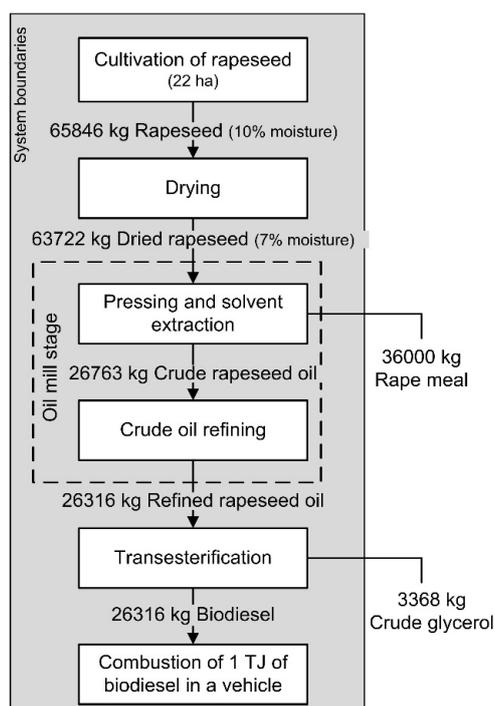
The objective of this study is to conduct a LCA of biodiesel manufactured in Serbia using locally sourced feedstock, such as rapeseed. Additionally, the aim is to identify environmental hotspots throughout the complex life cycle of biodiesel and propose measures for minimizing both its carbon footprint and non-energy resource demands.

## 2. METHOD

The life cycle assessment of biodiesel was conducted in accordance with ISO 14040:2006 standard, with adherence to the principles of attributional LCA (Ekvall, 2019). The LCA methodology comprises four main steps: goal and scope definition, inventory analysis (LCI), life cycle impact assessment (LCIA), and life cycle interpretation.

### 2.1. Goal and scope

This study aims to evaluate the carbon footprint (CF) and cumulative energy demand (CED) of rapeseed biodiesel, commonly referred to as rapeseed methyl ester (RME), produced in Serbia. The functional unit (FU) is defined as 1 TJ of energy, equating to 26,316 kg of biodiesel, based on a lower heating value (LHV) of 38 MJ/kg. System boundaries encompass all pertinent stages in the biodiesel life cycle, including the entire production chain of RME and its subsequent combustion in the internal combustion engine of a road vehicle. Primary and secondary data were employed to establish the inventory of key processes in foreground system (refer to Fig. 1), while the background system was modeled using relevant datasets from the ecoinvent 3.7 (Wernet et al., 2016) life cycle inventory (LCI) database (see Table 1). Processes associated with the production, maintenance, and end-of-life treatment of machinery, equipment, buildings, and infrastructure within the foreground system are excluded from the study. Nevertheless, their contribution to the overall results is typically minor, thus their exclusion is unlikely to significantly impact the outcomes. In attributional LCA, system boundaries “ideally contain processes that are actually directly linked by (physical, energy, and service) flows to the unit process that supplies the functional unit or reference flow (Sonnemann&Vigon, 2011)”. Therefore, indirect impacts, such as GHG emissions associated with indirect land-use change, are not taken into account when calculating the carbon footprint of biodiesel. Multifunctionality is addressed by allocating the overall impacts of multifunctional processes among their co-products based on economic value. The issue of multifunctionality in LCAs of biodiesel is thoroughly discussed in our previous paper (Kiš&Bošković, 2013), which also outlines the economic allocation procedure utilized in this study.



**Figure 1:** Main material flows in the life cycle of rapeseed biodiesel  
**Source:** authors' own depiction

### 2.2. Life cycle inventory (LCI) analysis

Inventory analysis involves compiling and quantifying inputs and outputs for the analyzed product system. Below is a brief description of the main processes comprising the life cycle of biodiesel and the associated input/output flows.

*Production of oilseed rape.* It is assumed that rapeseed is cultivated in the Vojvodina region, which currently accounts for approximately 80% of domestic rapeseed production. The required inputs (fertilizers, pesticides and diesel fuel) for achieving the targeted rapeseed yield of 3,000 kg/ha (with 10% moisture content) were estimated based on recommendations from relevant agricultural advisory institutions, considering the predominant local conditions in

Vojvodina, such as soil types, fertility, and climate. The targeted yield aligns well with the five-year (2018-2022) average rapeseed yields in Vojvodina. Detailed description of the agricultural operations and inputs associated with rapeseed production in Vojvodina is available from Kiš et al. (in press). Greenhouse gas (GHG) emissions occur during diesel combustion in agricultural machinery and fertilization. Tier 2 emission factors from the EMEP/EEA 2019 study (Winter and Dore, 2019) were used to determine the amount of GHGs, such as carbon dioxide (CO<sub>2</sub>), methane (CH<sub>4</sub>), and dinitrogen monoxide (N<sub>2</sub>O), released with the combustion of diesel fuels in agricultural machines (for details see Kiš et al., in press). The only GHG released due to the application of mineral fertilizers is N<sub>2</sub>O. The amount of N<sub>2</sub>O is estimated using the most recent guidelines of the IPCC (Hergoualc'h et al., 2019) which apart from direct emissions of N<sub>2</sub>O from mineral fertilizers and crop residues also considers indirect N<sub>2</sub>O emissions from volatilisation, leaching and runoff of nitrogen from fertilizers and crop residues (the calculation procedure is described in more details in Kiš et al. (in press)). Rapeseed is assumed as the sole marketable output, with crop residues left in the field. After harvest, rapeseed is transported to a dryer, using a tractor equipped with two 8-tonne trailers.

*Drying of rapeseed.* Rapeseed undergoes drying in an indirect gravity dryer to reduce moisture content to 7%, optimal for storage and processing (Maslač, 2021). The dryer employs natural gas as a heat source, with a specific thermal energy consumption of 5700 kJ per kg of evaporated water (Grbić, Lučić, Bicok, & Đukić, 2020). Electrical energy consumption is estimated at 2.7 kWh per tonne of seed. (Ivan Pavkov, Faculty of Agriculture, University of Novi Sad, pers. commun.).

*Pressing and extraction of rapeseed oil.* The dried rapeseed is transported with 28-tonne truck to the oil mill located 80 km from the dryer. The inventory of the oil mill stage is based on reports from a Danish AAK oil mill from Aarhus (Schmidt, 2007). Similar to Serbian oil mills, the production line at AAK comprises seeds pretreatment and pressing plant, along with solvent extraction. Among the materials used, only hexane is utilized in significant quantities, consumed at a rate of 1.19 kg per tonne of pressed and extracted rapeseed oil. The energy supply to the oil mill encompasses electricity and steam. Steam is co-produced with electricity within the mill through a combined heat and power plant (CHP) fueled by fuel oil. Energy consumption associated with both pressing and extraction amounts to 1590 MJ of heat energy (generated by combusting approximately 43 kg of fuel oil in the CHP plant) and 419 MJ of electricity (of which around 90 MJ is produced within the CHP plant) per one tonne of produced oil (Schmidt, 2007). During the process, rapeseed meal is co-produced with rapeseed oil in quantities specified in Fig. 1. Allocation factors were estimated using the average Serbian export prices of rapeseed oil (1195 USD/t) and meal (326 USD/t) in the period 2020-2023 available from the Statistical Office of the Republic of Serbia database.

*Rapeseed oil refining.* In the crude oil refining process, free fatty acids are converted into soaps by adding sodium hydroxide and removed by centrifugation. Other impurities are removed by filtration using acid-treated bleaching clay. In the refining process, 6.1 kg of light fuel oil and 104 MJ of electrical energy (part of this amount, around 13 MJ, is co-produced with steam in the CHP plant) are consumed per ton of crude oil (Schmidt, 2007).

*Transesterification of refined oil into biodiesel.* In this study, it is assumed that biodiesel is produced from refined rapeseed oil using a continuous alkali-catalyzed homogeneous process, with methanol as the alcohol for transesterification. This method is also employed at VictoriaOil in Šid, which is currently the largest biodiesel plant in Serbia. The oil mill and the transesterification plant are adjacent to each other; therefore, transportation of refined oil is not included in the inventory. A description of the process, along with a detailed inventory of material and energy flows associated with the production of one tonne of biodiesel, is provided in our previous article (Kiss, Bošković, & Jovanović, 2010). During the transesterification process, glycerol is co-produced with biodiesel at a rate of 128 kg per tonne of biodiesel. Consequently, part of the overall impact is attributed to the glycerol co-product, under the assumption that the market prices of biodiesel and glycerol are 285 USD/t (ChemAnalyst, 2024) and 1170 USD/t (Burgin, Foss, & Gomez, 2023), respectively.

*Combustion of biodiesel.* In this study, we assume the utilization of biodiesel for providing freight transport services via a lorry with a maximum payload of 28 tonnes, equipped with an engine compliant with EURO3 emission standards. The specific fuel consumption (45.86 g/tkm or 26,316 kg/FU considering LHV of biodiesel as 38 MJ/kg) and GHG emissions from the operation of the lorry (as outlined in Table 1) are estimated based on data from the relevantecoinvent report (Spielmann, Bauer, Dones, & Tuchschnid, 2007). The life cycle environmental impacts of a biodiesel-fueled lorry are compared with those of a fossil diesel-fueled counterpart, both evaluated based on the same functional unit (1 TJ of delivered energy). Due to the differing LHVs of biodiesel and fossil diesel (38 and 43 MJ/kg, respectively), the impact of biodiesel is evaluated against the equivalent energy content of 23,256 kg of fossil diesel fuel.

Table 1 provides an overview of the material and energy flows associated with each process in the foreground system, along with references to the LCI data used to calculate the impacts associated with them.

**Table 1:** Flows associated with the life cycle of rapeseed biodiesel (per FU) and source of LCI data

Life cycle phase	Processes/Flows	Unit	Amount (a)	Amount (b)	Source of LCI data
Rapeseed cultivation	Seed	kg	88	62	ecoinvent 3.7
	Diesel, low-sulphur	kg	2,269	1,606	ecoinvent 3.7
	Lubricating oil	kg	14	10	ecoinvent 3.7
	NPK (6:12:24)	kg	10,974	7,771	ecoinvent 3.7 (c)
	AN (33.5% N)	kg	6,585	4,663	ecoinvent 3.7
	Pesticides, unspecified	kg a.i.	30	21	ecoinvent 3.7
	Water for diluting pesticides	kg	39,508	27,975	ecoinvent 3.7
	GHG emissions from the combustion of diesel fuel	kg CO <sub>2eq.</sub>	7,367	5,217	Winter and Dore (2019)
	N <sub>2</sub> O emissions from the application of N fertilizers	kg N <sub>2</sub> O	38	27	based on Hergoualc'h et al. (2019)
	Transport (tractor with trailers)	tkm	658	466	ecoinvent 3.7
Seed drying	Electricity	kWh	178	126	ecoinvent 3.7
	Heat, from natural gas	MJ	12,107	8,573	ecoinvent 3.7
Oil pressing and extraction	Hexane				ecoinvent 3.7
	Electricity	MJ	32	23	ecoinvent 3.7
	Heat, from light fuel oil	MJ	8,788	6,223	ecoinvent 3.7
	Tap water	kg	48,724	34,501	ecoinvent 3.7
	Heat, from natural gas	MJ	5,106	3,616	ecoinvent 3.7
	Transport (16-32 t truck)	tkm	54	38	ecoinvent 3.7
Oil refining	Electricity	MJ	2,398	2,326	ecoinvent 3.7
	Heat, from light fuel oil	MJ	6,810	6,605	ecoinvent 3.7
	Tap water	kg	714	692	ecoinvent 3.7
	Heat, from natural gas	MJ	8	8	ecoinvent 3.7
	Phosphoric acid	kg	21	20	ecoinvent 3.7
	Sodium hydroxide	kg	55	54	ecoinvent 3.7
	Sulfuric acid	kg	50	49	ecoinvent 3.7
	Activated bentonite	kg	237	230	ecoinvent 3.7
Transesterification	Heat, from natural gas	kg	32,545	31,568	ecoinvent 3.7
	Electricity	MJ	2,018	1,958	ecoinvent 3.7
	Deionised water	MJ	9,211	8,934	ecoinvent 3.7
	Sodium methoxide	kg	132	128	ecoinvent 3.7
	Sodium hydroxide	kg	39	38	ecoinvent 3.7
	Methanol	kg	2,526	2,451	ecoinvent 3.7
	Hydrochloric acid	kg	263	255	ecoinvent 3.7
	Tap water	kg	3,803	3,689	ecoinvent 3.7
Combustion of biodiesel	CO <sub>2</sub> , biogenic, to air	kg	70,510	70,510	based on Spielmann et al. (2007)
	CO <sub>2</sub> , fossil, to air (d)	kg	3,917	3,917	
	CH <sub>4</sub> , to air	g	397	397	
	N <sub>2</sub> O, to air	g	695	695	

Note: (a) before co-product allocation; (b) after co-product allocation; (c) modified ecoinvent 3.7 process (see Kiš et al., in press); (d) a portion of the carbon in RME originates from methanol, which accounts for CO<sub>2</sub> emissions of fossil origin.

Source: authors' own compilation

### 2.3. Life cycle impact assessment (LCIA)

The carbon footprint (measured in kg CO<sub>2</sub>-equivalent emissions, CO<sub>2eq.</sub>) of biodiesel was computed using the ReCiPe 2016 Midpoint (H) LCIA method, which aligns with the IPCC methodology and characterization factors (Huijbregts et al., 2017). In this study, it is assumed that carbon emissions originating from biomass (i.e., biogenic CO<sub>2</sub> emissions) are neutral in terms of global warming and therefore are excluded from GHG emissions. Likewise, the biodiesel fuel chain does not receive credit for carbon sequestered during plant growth. The cumulative energy demand is assessed using the CED LCIA method (Frischknecht et al., 2007). Implementation of life cycle impact assessment methods, which considers all relevant non-renewable and renewable energy sources utilized in the analyzed product system. Both LCIA methods and the ecoinvent 3.7, which provided most of the LCI data for background processes, are integrated into the OpenLCA v. 13 LCA software, which was utilized for the calculation process.

### 3. RESULTS AND DISCUSSION

The carbon footprint and cumulative energy demand of biodiesel and fossil diesel are presented in Table 2. The carbon footprint of rapeseed biodiesel is 44 g CO<sub>2eq</sub>/MJ, and it is approximately 50% lower than that of fossil diesel, which was estimated at 86 g CO<sub>2eq</sub>/MJ. It's important to note that in this study, we did not consider the rather controversial issue of indirect land-use change (iLUC) induced by biofuel production (see Finkbeiner, 2014). Consequently, the presented LCIA results do not include the potential impacts associated with iLUC, which, according to Directive (EU) 2018/2001, can range between 33 to 66 g CO<sub>2eq</sub>/MJ, with a mean value of 55 g CO<sub>2eq</sub>/MJ for oil crops derived biodiesel.

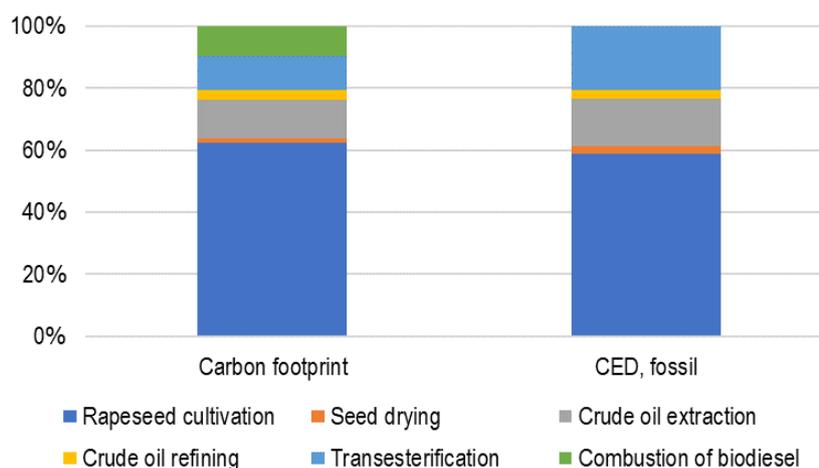
The estimated life-cycle fossil energy inputs (fossil CED) for rapeseed biodiesel were 0.53 MJ/MJ of biodiesel, indicating that the energy in biodiesel is almost two times greater than the fossil-based energy required to produce it. In contrast, fossil diesel requires 30% more fossil energy than is present in the fuel, resulting in an unfavorable ratio of energy output to energy input of 0.76 (calculated from Table 2). The CED LCIA method also accounts for energy sources other than fossil fuel, but given their minor contribution to overall energy usage (Table 2), the following discussion focuses on the fossil energy demand of the investigated product systems.

**Table 2:** Carbon footprint (kg CO<sub>2eq</sub>/FU) and cumulative energy demand (MJ/FU) of biodiesel and fossil diesel

Indicator	Seed production	Seed drying	Crude oil extraction	Crude oil refining	Transesterification	Combustion of biodiesel	Total, biodiesel	Total, fossil diesel <sup>(c)</sup>
Carbon footprint	27,292	739	5,403	1,456	4,850	4,141	43,880	86,216
Cumulative energy demand								
fossil <sup>(a)</sup>	284,635	12,170	73,671	19,437	136,061	0	525,975	1,310,984
biomass <sup>(b)</sup>	5,513	7	115	106	245	0	5,986	903
nuclear <sup>(a)</sup>	12,614	160	1,832	889	2,364	0	17,860	4,668
water <sup>(b)</sup>	3,475	169	2,017	863	1,216	0	7,740	1,798
wind, solar, geothermal <sup>(b)</sup>	1,903	18	175	92	288	0	2,475	567

Notes: <sup>(a)</sup> non-renewable, <sup>(b)</sup> renewable, <sup>(c)</sup> estimated based on the ecoinvent 3.7 process, which describes road transport using a lorry with a weight capacity of 16-32 tonnes equipped with an engine compliant with EURO3 emission standards.

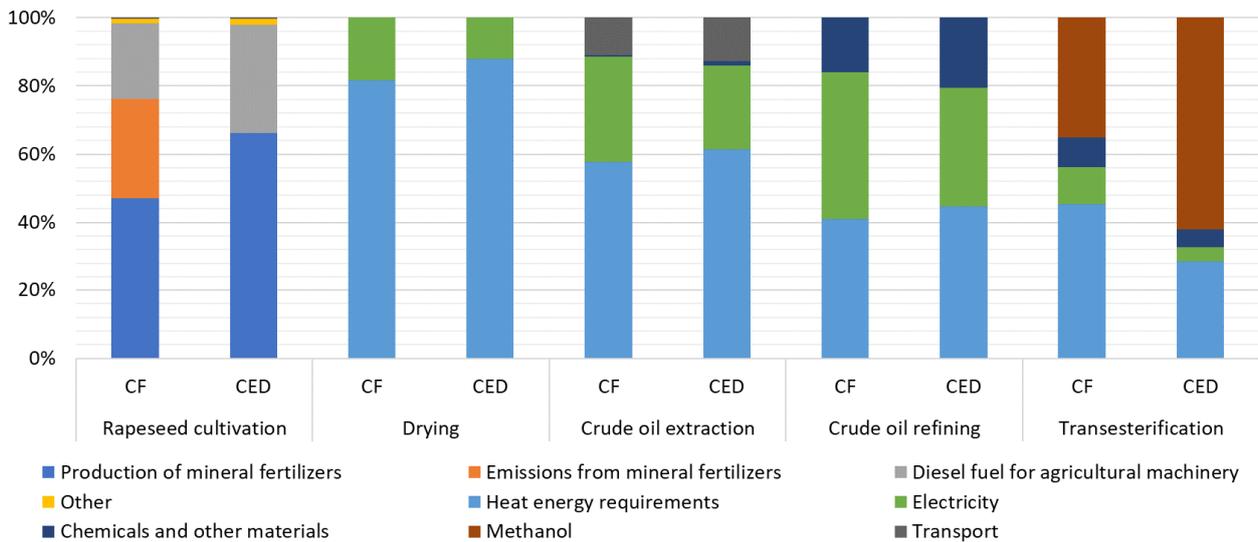
**Source:** authors' own compilation



**Figure 2:** Contribution of life cycle stages to carbon footprint and fossil energy demand of biodiesel

**Source:** authors' own depiction

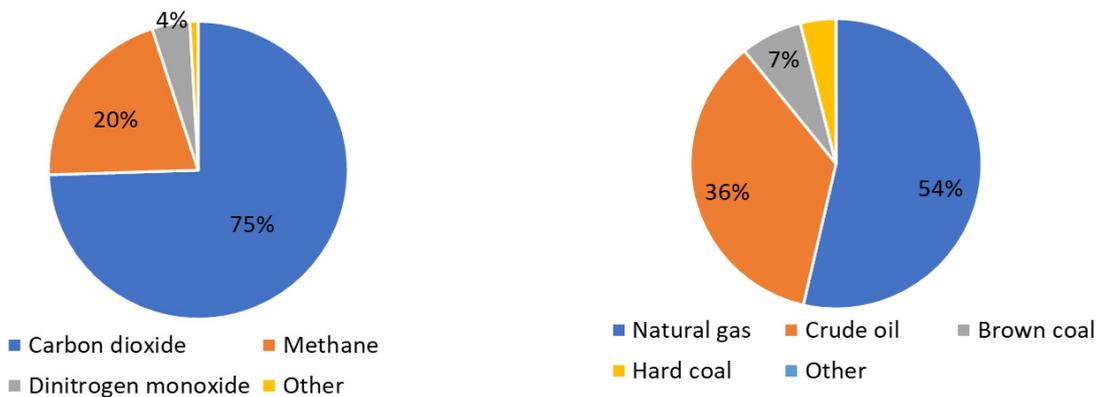
Rapeseed cultivation and its associated processes contribute to 62% of the biodiesel's carbon footprint and account for 76% of the fossil energy consumed throughout its life cycle (Fig. 2). GHGs related to fertilizers contribute to 75% of the total carbon footprint of rapeseed production. Around two-thirds of the carbon footprint of mineral fertilizers is due to the emissions of GHGs in their production chain, while the rest is attributed to N<sub>2</sub>O emissions after the application of nitrogen fertilizers (Fig. 3). The remaining portion of the carbon footprint during the agricultural stage is primarily attributed to GHG emissions associated with diesel fuel used in agricultural machinery (Fig. 3). Similarly, the fossil energy requirements of rapeseed production are predominantly associated with the usage of mineral fertilizers and diesel fuel (Fig. 3).



**Figure 3:** Contribution of processes to carbon footprint and fossil energy demand of biodiesel  
**Source:** authors' own depiction

Processes within the oil mill stage (crude oil extraction and refining) contribute with 15%, while the transesterification stage is responsible for 11% of the GHG emission impacts in the biodiesel's life cycle (Fig. 2). In the oil mill stage, activities related to the production and utilization of heat energy and electricity required by the plant contribute significantly to both impact categories investigated (Fig. 3). Chemicals utilized during solvent extraction and the refining process exert a minor influence on the results. The notable share of transport-related impacts in crude oil production is due to accounting for impacts associated with the transport of dried rapeseed in the oil mill stage rather than in the seed drying stage.

In the transesterification process, the production of methanol and other chemicals used in the process contributes to 44% of the carbon footprint and 67% of the fossil CED of the process, followed by the production and utilization of energy required by the plant (Fig. 3). The significant portion of global warming impacts associated with chemicals in the transesterification stage primarily arises from the substantial GHG emissions released during methanol manufacturing. Environmental impacts linked to the grain drying stage are relatively minor, mainly driven by the heat and electricity requirements of the process (Figs 2 and 3).

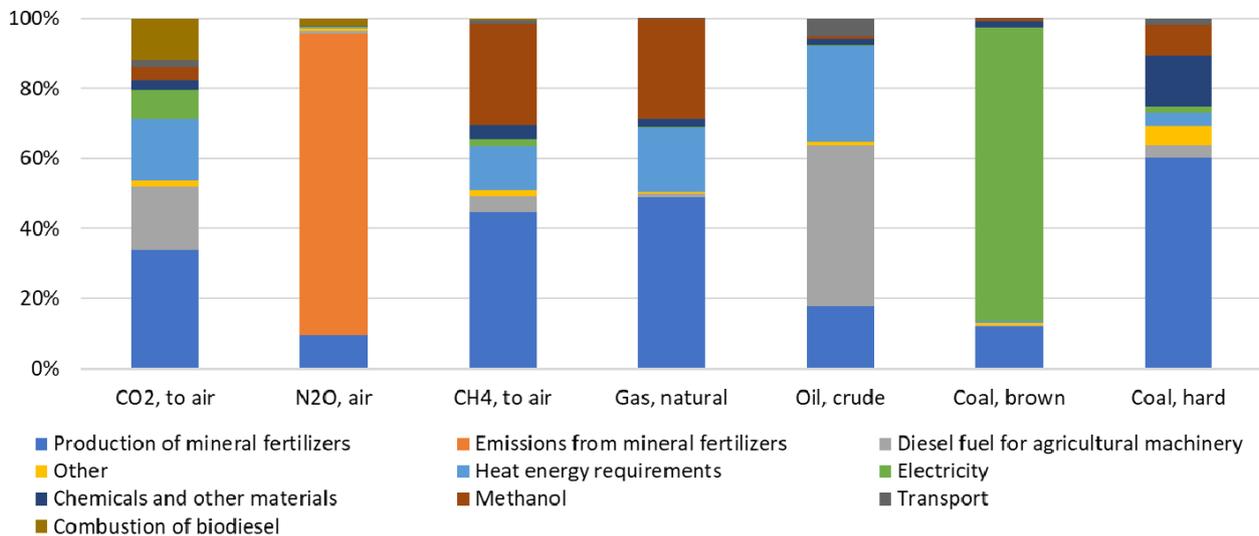


**Figure 4:** Contribution of elementary flows to category indicator results (left: CF, right: fossil CED)  
**Source:** authors' own depiction

As observed in Fig. 4, only a select few GHGs and fossil energy resources significantly contribute to the estimated carbon footprint and fossil energy consumption of biodiesel. Carbon dioxide stands out as the primary contributor to biodiesel's carbon footprint, followed by CH<sub>4</sub> and N<sub>2</sub>O. Processes linked to the production chain of mineral fertilizers and the life cycle of diesel fuel used in agricultural machinery collectively account for roughly half of the total fossil CO<sub>2</sub> and CH<sub>4</sub> emissions in the life cycle of RME, as illustrated in Fig. 5. Additionally, the combustion of fossil fuels for heat generation and electricity production represents another notable source of CO<sub>2</sub> and CH<sub>4</sub> emissions.

The significant contribution of methanol to CH<sub>4</sub> emissions (exceeding 30%, as depicted in Fig. 5) is attributed to the primary method of methanol production, which relies on steam reforming of natural gas. N<sub>2</sub>O emissions in the life cycle of RME are predominantly associated with the application of nitrogen fertilizers.

Crude oil and natural gas consumption collectively account for approximately 90% of the fossil CED of biodiesel. Processes driving natural gas consumption closely parallel those contributing to CH<sub>4</sub> emissions (see Fig. 5), underscoring the strong correlation between natural gas consumption and CH<sub>4</sub> emissions. Predictably, diesel consumption in agricultural machinery constitutes the primary factor contributing to the depletion of crude oil reserves. Furthermore, heat generation also contributes to crude oil consumption mainly because light fuel oil is used as the primary fuel in the oil mill stage (Fig. 5). Brown coal (often referred to as lignite) consumption contributes around 7% to the total fossil CED of biodiesel and is closely related to electricity consumption, since electricity generation in Serbia relies heavily on lignite fuel power plants.



**Figure 5:** Contribution of specific processes to emissions and resource use in the life cycle of biodiesel  
**Source:** authors' own depiction

## 4. CONCLUSIONS

The analysis of carbon footprint and cumulative energy demand provides valuable insights into the sustainability of biodiesel derived from rapeseed oil compared to fossil diesel. The results demonstrate a clear advantage for rapeseed biodiesel, with an approximately 50% lower carbon footprint than that of fossil diesel. Moreover, the analysis reveals that rapeseed biodiesel exhibits a favorable energy balance, with almost twice the energy content compared to the fossil energy inputs required for its production. However, it's crucial to acknowledge that the assessment does not consider the potentially significant global warming impacts of indirect land-use change (iLUC) induced by biofuel production, which could cast doubt on the sustainability of biodiesel production.

The cultivation of rapeseed and associated processes contribute substantially to its environmental footprint, predominantly due to GHG emissions and fossil energy use in the life cycle of fertilizers and fuels used in agricultural activities. Furthermore, processes within the oil mill and transesterification stages significantly contribute to GHG emissions and energy consumption. Notably, the production of methanol and chemicals in the transesterification process emerges as a major hotspot, primarily due to GHG emissions released during methanol manufacturing. Additionally, crude oil and natural gas consumption drive the majority of fossil energy demand, emphasizing the need for efficiency improvements in energy-intensive stages.

To enhance the sustainability of rapeseed biodiesel production, several strategies can be pursued. Firstly, optimizing agricultural practices to minimize fertilizer usage and diesel fuel consumption per unit of yield can substantially reduce emissions and energy demand in the cultivation stage. Similarly, improving energy efficiency and transitioning to renewable energy sources in oil extraction and chemical processing stages can mitigate environmental impacts. Furthermore, innovation in production methods, such as utilizing alternative feedstocks (e.g. using bioethanol instead of methanol) or implementing advanced conversion technologies, holds potential for reducing emissions and energy consumption throughout the biodiesel production chain.

Overall, while rapeseed biodiesel offers environmental benefits over fossil diesel, addressing key hotspots in its life cycle is essential for realizing its full potential as a sustainable energy source. Continued research, technological innovation, and policy support are crucial for driving improvements and ensuring the long-term viability of biodiesel production in contributing to global energy needs while minimizing environmental degradation.

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**Bojana Vuković**Faculty of Economics in Subotica, University of  
Novi Sad

Subotica, Republic of Serbia

bojana.vukovic@ef.uns.ac.rs

**Nedeljko Tica**

Faculty of Agriculture, University of Novi Sad

Novi Sad, Republic of Serbia

nedeljko.tica@polj.edu.rs

**Teodora Ilić**Faculty of Economics in Subotica, University of  
Novi Sad

Subotica, Republic of Serbia

teodora.tica@ef.uns.ac.rs

**Dejan Jakšić**Faculty of Economics in Subotica, University of  
Novi Sad

Subotica, Republic of Serbia

dejan.jaksic@ef.uns.ac.rs

## **PROFITABILITY DYNAMICS OF FOOD COMPANIES AMIDST COVID-19 CHALLENGES: EVIDENCE FROM SERBIA**

**Abstract:** This study examines the impact of the COVID-19 pandemic on the profitability of food companies in Serbia. Lockdown measures, production, and supply chain disruptions, shifts in consumer behavior, and increased operational costs significantly impacted the food industry. The research was conducted on financial data from 1661 companies operating from 2018 to 2022. The assessment of the panel data model confirmed the presence of a negative and statistically significant effect of the Covid-19 epidemic on profitability as measured by return on total assets (ROA).

**Keywords:** Food Sector, Covid-19, Profitability, ROA

### **INTRODUCTION**

The food industry serves as the primary market for agricultural raw materials, playing a crucial role in ensuring food stability. In the Republic of Serbia, the economic importance of the food sector is derived from favorable agroecological conditions, abundant arable land, a well-structured agricultural landscape, a longstanding tradition in food production, and its proximity to the European Union market. The relatively high share of agriculture and the food industry, or agricultural-food products in the export structure of the Republic of Serbia, is the result of favorable resources for their production, as well as the slow development and decreasing share of other sectors in exports (Božić & Nikolić, 2023). Although the food sector holds a significant share in the economy of the Republic of Serbia, in terms of export potential and employment, COVID-19 has had significant impacts on demand and challenges in supply realization. Additionally, there are constraints in accessing capital and obtaining necessary investment funds, as well as limitations in international capital flows (Eit Food, 2020). Furthermore, changes in consumer behavior regarding risk aversion levels and uncertainty regarding future production and potential legislative changes are present. The COVID-19 pandemic has underscored the importance of digitalization and changes in consumer preferences, imposing trends that the food industry sector has had to adapt to.

The key long-term challenge in the context of COVID-19 has been ensuring a secure supply of food products. The primary concern for food security lies not in the availability of food but in consumers' ability to access it. As lockdowns and other COVID-19 disruptions contribute to a worldwide economic downturn, millions are either losing their jobs or facing significant reductions in their incomes. COVID-19 has caused disruptions across all aspects of food supply chains, impacting farm production, food processing, transportation, logistics, and consumer demand simultaneously (OECD, 2020). The food industry has been notably impacted by physical distancing requirements, quarantine measures, security and safety protocols, and disruptions across the supply chain (Vučenović et al., 2021).

This study aims to analyze how Covid 19 influence the profitability of food companies operating in the Republic of Serbia during the time period 2018-2022. The selection of other indicators is based on theoretical perspectives and the

results of empirical studies in the previous period. The obtained results should indicate the nature of the relationship between the identified indicators and profitability, in order to identify the impact of the COVID-19 pandemic on the profitability of companies in the food industry sector of the Republic of Serbia. Given the crucial role the food industry played during movement restrictions, the research focused on a sample of companies within this sector, bearing in mind that the profitability of companies in the food sector is often conditioned by their reputation and competitive market position. Food sector in the Republic of Serbia is characterized by a prominent dual structure, comprising numerous small and medium-sized enterprises alongside a few large companies. Despite foreign direct investment, the sector's limited investment in modern technology and efforts to enhance production efficiency are thought to adversely impact its prospects (Domanović et al., 2018).

The structure of the paper is organized as follows: we commence with laying out the theoretical framework and developing hypotheses. Subsequently, we introduce the data and methodology, followed by the presentation of empirical results and discussion. Finally, the conclusion encapsulates the limitations and provides future recommendations.

## **THEORETICAL BACKGROUND**

The profitability of companies in the food sector is measured through return on assets (ROA) as a determinant of the company's ability to generate income from available assets. In order to assess the impact of the COVID-19 pandemic on the profitability of Serbian food industry companies in the time period 2018-2022, and relying on previous empirical studies in this area, the independent variables used are current ratio, asset structure ratio, debt to assets, debt to equity, and firm size.

There is minor previous research on this topic. One of them is a study conducted by Mijailović et al. (2023) which explored how the financial performance of top-performing meat industry businesses measured by ROA was affected by the COVID-19 pandemic. Notably, the research results indicate a positive impact of the pandemic on the profitability of the meat industry in the Serbia in time period 2016–2020. The findings offer valuable insights for businesses to identify areas of vulnerability and potential avenues for improving financial outcomes. Other previous research addressing this topic is mostly based on examining the impact of COVID-19 on the profitability of companies in other sectors and countries. In that direction, the study conducted by Tica et al. (2023a) revealed a statistically significant adverse impact of the COVID-19 pandemic on the profitability of construction companies in Bosnia and Herzegovina from 2014 to 2020. The need for residential and non-residential construction projects in Bosnia and Herzegovina was experienced growth during 2020, coinciding with the onset of the pandemic. Furthermore, Tica et al. (2023b) suggested a statistically significant positive correlation between the COVID-19 pandemic and the profitability of operating companies within the logistics sector, located in the Western Balkans, operating from 2015 to 2020. Their findings validated the unique nature of the logistics sector, highlighting it as one of the rare industries that have been able to attain increased profitability amidst the crisis and recession triggered by the early 2020 pandemic.

The findings of Gomes et al. (2022) research indicate a detrimental effect of the COVID-19 pandemic on profitability within the restaurant sector, with this trend observed across both countries, Spain, and Portugal. The worldwide crisis triggered by COVID-19 in 2020 severely impacted the profitability of restaurants, escalated their debt burden, and jeopardized numerous jobs. Amnim et al. (2021) conducted a study on how the profitability of companies in Nigeria's consumer goods and healthcare sectors were influenced by the Covid-19 pandemic. Their findings revealed a statistically significant positive correlation between the pandemic and company profitability. Additionally, the authors suggested that retail companies could mitigate the adverse effects of the Covid-19 pandemic by implementing flexible supply and distribution models for their products to customers. The study conducted by Devi et al. (2021) revealed that during the pandemic, the consumer goods sector experienced a rise in profitability, whereas other sectors such as trade, utilities, transportation, infrastructure, finance, real estate, and investment witnessed a decline in profitability.

Demirhan & Sakin (2021) investigated how the COVID-19 pandemic impacted the profitability of manufacturing and non-manufacturing firms, excluding financial institutions such as holdings, banks, and investment trusts listed on the Borsa Istanbul. Their findings revealed a detrimental effect of COVID-19 on these companies' profitability from 2017 to 2021, potentially stemming from ineffective asset and equity management. Lockdown measures during the pandemic exacerbated cost management challenges for non-manufacturing firms, while manufacturing firms managed to sustain operations despite the restrictions, unlike those in the service industry. By studying a selection of Chinese listed companies, Xiong et al. (2020) observed that the market's reaction to the COVID-19 outbreak was heightened among firms operating in industries most vulnerable to the virus and those with substantial institutional investor involvement. Additionally, companies with greater size and better profitability experienced comparatively milder negative impacts from the COVID-19 outbreak than their counterparts.

Taking into account the purpose and issue addressed in this paper, along with the conclusions drawn by previous researchers, the hypothesis to be examined in this study is:

Hypothesis 1: The Covid-19 pandemic has a negative and statistically significant effect on the profitability of companies in the food sector in the Republic of Serbia in the time period from 2018 to 2022.

## DATA & METHODOLOGY

The aim of the research is to examine the impact of the COVID-19 pandemic on the profitability of food companies in Serbia. A total of 8,305 observations are included in the data set, which is comprised of 1,661 companies based in Serbia. All sampled companies actively operated in the food industry over the time period from 2018 to 2022. Financial data is obtained from publicly disclosed financial reports from The Serbian Business Registers Agency. Based on previous studies together with the financial information that is available in the financial statements, the variables were selected in order to evaluate the model utilizing the panel regression analysis.

The following table provides a presentation of the variables that have been determined to be either dependent or independent in the assessed model.

**Table 1:** A summary of research variables

Variable	Name	Computation	Source
Dependent	Profitability	ROA=Net profit/Total Assets	Demirhan & Sakin (2021); Devi, et al. (2021); Domanović et al. (2018); Mijailović et al. (2023); Tica et al. (2023a); Tica et al. (2023b).
Independent	Liquidity	Current ratio=Current Assets/Current Liabilities	Amnim et al. (2021); Devi, et al. (2021); Tica et al. (2023a); Tica et al. (2023b).
	Asset Structure	Fixed assets/Total assets	Tica et al. (2023a); Tica et al. (2023b).
	Debt-to-asset	Debt/Total Assets	Demirhan & Sakin (2021); Gomes et al (2022); Shen et al. (2020); Tica et al. (2023b).
	Debt-to-equity	Debt/Total Equity	Devi, et al. (2021);
	Firm Size	Natural logarithm of Total Assets	Demirhan & Sakin (2021); Shen et al. (2020); Tica et al. (2023b).
	Covid-19	1 for Covid-19 years, 0 for non-covid-19 years	Shen, et al. (2020), Atayah, et al. (2021); Devi, et al. (2021); (Amnim et al., 2021).

**Source:** Authors' computations

To achieve this aim, the study will employ panel data analysis as the primary methodological framework. Panel data analysis, also known as longitudinal data analysis or cross-sectional time-series analysis, is a robust statistical method particularly suited for examining changes over time across different entities.

## RESULTS & DISCUSSION

A descriptive statistical examination is performed on all the model variables, and the findings are presented in Table 2. When conducting an analysis of the average values, the median is the statistical measure of choice rather than the arithmetic mean. This is because extreme values are commonly found. There is an acceptable rate of profitability among the food enterprises, as indicated by the median value of the variable ROA, which is 3.17%. There is a low degree of current liquidity, as indicated by the fact that the median of the current ratio values 1.415. This indicates that firms in the food industry have a limited capacity to fulfill their short-term debts using current assets. Additionally, the findings indicate that the asset structure is slightly skewed toward current assets. This is to be expected given the nature of the food sector activities, considering the characteristics of the sector whose operations include a large amount of inventory, production, and receivables. Furthermore, the median of debt-to-asset and debt-to-equity indicators reveals that sampled companies' sources rely more on owned funds rather than borrowed.

**Table 2:** Descriptive statistical examination

Variable	Observation	Median	Mean	Minimum	Maximum	St. deviation
Profitability	8,305	3.173	5.938	-95.209	93.75	10.820
Liquidity	8,305	1.415	2.539	0.003	82.168	4.835
Asset Structure	8,305	0.334	0.354	0.000	1.000	0.262

Debt-to-asset	8,305	0.075	0.137	0.000	0.962	0.172
Debt-to-equity	8,305	0.182	2.229	0.000	2.408	45.883
Firm Size	8,305	5.541	5.621	-1.778	12.870	2.157
Covid-19	8,305	1.000	0.600	0.000	1.000	0.490

Source: Authors' computations

Given the results of Pearson's matrix shown in Table 3, the initial predictions about the course and significance of the relationship among the variables could be made. The findings of matrix reveal a statistically significant connection among all independent variables and ROA, with the exception of the linear relationship between debt-to-equity and profitability. Furthermore, there exists a negative correlation between the coronavirus epidemic and the profitability.

**Table 3:** Findings of Pearson's matrix

Variable	Profitability	Liquidity	Asset Structure	Debt-to-asset	Debt-to-equity	Firm Size	Covid-19
Profitability	1.0000						
Liquidity	0.0922*	1.0000					
Asset Structure	-0.1318*	-0.1359*	1.0000				
Debt-to-asset	-0.1214*	-0.2199*	0.0275*	1.0000			
Debt-to-equity	-0.0215	-0.0165	-0.0018	0.0827*	1.0000		
Firm Size	-0.1721*	-0.0337*	0.3467*	0.0091	-0.0283	1.0000	
Covid-19	-0.0476*	0.0172	-0.0109	-0.0528	0.0010	0.0611*	1.0000

\* - level of significance > 0.05

Source: Authors' computations

Prior to beginning the panel data assessment, it is imperative to assess the underlying assumptions intended for the implementation of the selected methodology. One of the key premises behind the utilization of panel analysis is the absence of significant correlation among the independent variables, specifically the absence of multicollinearity. Table 4 presents the results of the Variance Impact Factors (VIF) test.

**Table 4:** Variance Impact Factors results

Variable	VIF	TOL (1/VIF)
Asset Structure	1.16	0.863418
Firm Size	1.14	0.874632
Liquidity	1.07	0.934522
Debt-to-asset	1.06	0.942881
Debt-to-equity	1.01	0.992219
Covid-19	1.01	0.992275

Source: Authors' computations

Based on the data in Table 5 showing that the VIF scores for all variables are below 10 and the TOL score surpasses 0.1, it may be inferred that there is no presence of multicollinearity in the preset model. The presence of heteroskedasticity and autocorrelation is subject of further examination.

**Table 5:** Variance Impact Factors results

Variable	Test statistic value	p value
Wooldridge test	2480.96	0.0000
Breusch-Pagan / Cook-Weisberg test	30.375	0.0000

Source: Authors' computations

The Wooldridge test results indicate that the p-value is below the level of 5%, confirming the presence of autocorrelation. The Breusch-Pagan / Cook-Weisberg test was applied to examine the existence of heteroskedasticity. The p-value obtained is found to be above the predetermined significance limit of 5%. The presence of heteroskedasticity was confirmed for the model. Given the breach of fundamental premises in panel analysis, the model should be transformed in order to conduct a thorough examination. Table 6 displays the revised regression model that is evaluated to determine whether Hypothesis 1 should be accepted or rejected.

**Table 6:** Findings of evaluated model

Variable	Coefficient value	p value
Liquidity	0.098	0.009
Asset Structure	-3.809	0.000
Debt-to-asset	-6.688	0.000
Debt-to-equity	-0.004	0.099
Firm Size	-0.690	0.000
Covid-19	-1.027	0.000
Constant	12.455	0.000

Source: Authors' computations

The empirical analysis conducted in this study provides robust evidence supporting Hypothesis 1. Through the utilization of return on assets (ROA) as a measure of profitability, it was observed that the Covid-19 pandemic indeed had a negative impact on the profitability dynamics of food companies in Serbia during the specified time period. The findings align with the anticipated negative effect postulated in the hypothesis and corroborate the observations made in previous research conducted within both domestic and international contexts (Demirhan & Sakin (2021), Gomes et al. (2022), Tica et al. (2023a))

The negative impact of the COVID-19 pandemic on profitability within the food sector in Serbia could be attributed to several interconnected factors. Firstly, the obligation of lockdown measures and mobility restrictions aimed at limiting the spread of the virus severely disrupted consumer behavior and consumption patterns. Secondly, supply chain disruptions emerged as a major challenge for food companies, compounded by logistical constraints, border closures, and disruptions in transportation networks. Furthermore, increased health and safety regulations necessitated costly investments in protective equipment, sanitation measures, and workplace reconfigurations to ensure compliance with health protocols and safeguard employee well-being. Additionally, shifts in consumer preferences towards essential food items characterized by longer shelf life, nutritional value, and affordability further exacerbated the challenges faced by food companies specializing in non-essential or premium products.

## CONCLUSION

In conclusion, this research sheds light on the complexities of the profitability dynamics within the food industry of Serbia amidst the challenges posed by the COVID-19 pandemic. The findings emphasize the impact of the pandemic on various facets of the food companies' operations, particularly on their profitability metrics. The implemented lockdown measures, disruptions in production and supply chains, shifts in consumer behavior, and escalated operational costs collectively contributed to a significant negative effect on the profitability of food companies in the country. Through the utilization of panel data analysis encompassing financial information from 1661 companies operating from 2018 to 2022, this study validates the empirical evidence of the adverse influence of the COVID-19 epidemic on the profitability, as measured by return on total assets (ROA). This negative and statistically significant effect underlines the vulnerability of food companies to external shocks, such as pandemics, and emphasizes the need for adaptive strategies and robust risk management frameworks to navigate through such turbulent times.

Moreover, the results emphasize the resilience and adaptability imperative for food companies to navigate through such unprecedented crises effectively. Strategies aimed at enhancing operational flexibility, strengthening supply chain resilience, and leveraging digitalization to meet evolving consumer demands emerge as critical considerations for mitigating the adverse impacts of future disruptions. This study contributes to the existing body of literature by providing empirical insights into the specific challenges faced by food companies amidst the COVID-19 pandemic in the Serbian context. Furthermore, the findings offer valuable implications for policymakers, industry stakeholders, and managerial practitioners in formulating strategies to bolster the resilience and sustainability of the food sector in the face of ongoing and future uncertainties.

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**Dragana Novaković**

Faculty of Agriculture, University of Novi Sad  
 Novi Sad, Republic of Serbia  
 dragana.tekic@polj.uns.ac.rs

**Mirela Tomaš Simin**

Faculty of Agriculture, University of Novi Sad  
 Novi Sad, Republic of Serbia  
 mirelat@polj.uns.ac.rs

**Dragan Milić**

Faculty of Agriculture, University of Novi Sad  
 Novi Sad, Republic of Serbia  
 dragan.milic@polj.edu.rs

**Tihomir Novaković**

Faculty of Agriculture, University of Novi Sad  
 Novi Sad, Republic of Serbia  
 tihomir.novakovic@polj.uns.ac.rs

## **PROFITABILITY DETERMINANTS OF AGRICULTURAL SMES FROM REPUBLIC OF SERBIA**

**Abstract:** This research focuses on small and medium-sized agricultural enterprises, serving as the vital contributors to the agricultural sector in the Republic of Serbia. The aim of the study is to analyze the profitability and factors influencing profitability of the observed enterprises based on a sample of 220 companies operating from 2014 to 2021. By applying panel regression analysis, it was concluded that financial leverage, company size, tangibility, and the ratio of total asset turnover have a statistically significant impact on the profitability of observed enterprises.

**Keywords:** Profitability, agriculture, panel analysis, SME.

### **1. INTRODUCTION**

Understanding and analyzing the profitability indicators of a company are key elements for assessing business success, especially in a sector such as agriculture, which is of vital importance to the economy of the Republic of Serbia (Jakšić, et al. 2015). Profitability is not only an indicator of the current financial status of a company but also a marker of its ability to sustain and develop in the long term. Information about a company's performance, especially its profitability, is useful in supporting managerial decisions regarding potential changes in the economic resources the company will be able to control in the future (Burja, 2011). By analyzing indicators like the Return on Assets (ROA), we can understand not only the financial state of the company but also its ability to respond to market and economic changes.

Agriculture in the Republic of Serbia represents a foundation of economic stability and development. Favorable climatic conditions and quality agricultural land in the Republic of Serbia are important factors for the successful operation of agricultural companies (Andrašić et al., 2018). Despite its significance, the sector faces a number of challenges, including variable market conditions, climate change, and increasingly strict regulations. Therefore, it is essential to carefully analyze how internal factors, as well as external factors such as market trends, economic conditions, and political changes, affect the profitability of small and medium-sized agricultural enterprises.

Given the importance of agriculture for the overall development of the economy of the Republic of Serbia, the subject of this research is small and medium-sized agricultural enterprises that operated in the period from 2014 to 2021. The aim of the research is to assess profitability and identify factors that influence the profitability of small and medium-sized agricultural enterprises in the Republic of Serbia. Through this analysis, we hope to provide valuable insights that can help in creating strategies to support the growth and sustainability of this sector, not only in terms of individual companies but also in the context of the wider contribution of agriculture to the overall economy and food security.

## 2. THEORETICAL BACKGROUND

Numerous authors, both globally and in our region, have analyzed the determinants of profitability in agricultural enterprises.

Suardi and Noor (2015) analyzed the impact of capital structure on the financial performance of agricultural enterprises in Indonesia. Their research included a sample of 16 agricultural enterprises operating in Indonesia from 2010 to 2014. Using multiple regression, the authors concluded that capital structure indicators significantly affect the profitability of the observed companies when profitability is measured by the return on equity, with both indicators negatively impacting profitability. Jacob and Collins (2016) focused on the profitability determinants of agricultural enterprises in Kenya, analyzing 7 enterprises from 2006 to 2014. Their findings showed that liquidity and company size positively and significantly impact the profitability of Kenyan agricultural enterprises, while the asset structure indicator negatively affects profitability. Shamsuddin et al. (2017) examined the factors influencing the financial performance of agricultural cooperatives in Malaysia from 2010 to 2014, analyzing 128 cooperatives using panel regression analysis. They found that the fixed asset turnover ratio, dividends, and company size had a significant impact on Return on Assets (ROA), while liquidity, fixed asset turnover ratio, and investments impacted Return on Equity (ROE).

Singh et al. (2019) conducted an analysis of the profitability determinants of agricultural cooperatives in the United States from 2009 to 2017, covering 37 cooperatives. The study revealed that only revenue growth had a positive and significant impact on the profitability of agricultural cooperatives, while the uncertainty index, size, and capital intensity had a negative significant impact. Sensini (2020) explored how working capital management affects the profitability of companies in the agricultural-food sector of Italy. Based on a sample of 112 small and medium enterprises from 2010 to 2016, the study analyzed how the working capital cycle, debt ratio, interest coverage, and the ratio of current and total assets impact gross profit margin. The results indicated that working capital management has a negative and significant impact on profitability, with less profitable companies having a longer working capital cycle. The study also found that the debt ratio negatively affects profitability, while interest coverage and the ratio of current and total assets have a positive impact. Xu et al. (2021) analyzed the impact of capital structure on the profitability of agricultural enterprises in China, examining 39 enterprises from 2013 to 2019. Using panel regression analysis, they concluded that financial leverage, the ratio of short-term liabilities to total assets, negatively impacts profitability, with company size and sales rate being the only positive and significant indicators.

Jakšić et al. (2016) analyzed the profitability of agricultural enterprises in Southeast European countries from 2012 to 2014, covering 3022 companies. Using a t-test, they investigated whether there were differences in profitability levels between EU member countries and others, and variance analysis to see if profitability differed among the countries in the sample. The research showed that EU member countries' companies were significantly more profitable and that there were significant differences in profitability among the countries observed. Andrašić et al. (2018) analyzed factors affecting the profitability of medium and large agricultural enterprises in AP Vojvodina from 2006 to 2015, including 420 companies. They concluded that all observed factors significantly impact profitability, with company size and financial leverage negatively affecting it, while other factors positively influence profitability. This research is significant for including insurance and export factors in the analysis. Milašinović and Mitrović (2020) focused on the internal determinants of profitability of agricultural enterprises in the Republic of Serbia, covering 15 companies registered under the group 0111 - growing of cereals (except rice), leguminous crops, and oilseeds from 2016 to 2018. Panel regression analysis revealed that only total asset efficiency and capitalization rate significantly impact profitability, with total asset efficiency positively influencing profitability, while the capitalization rate negatively affects it. Tekić et al. (2022) analyzed the determinants of profitability of small agricultural and food sector enterprises in the Republic of Serbia from 2010 to 2019. Their panel regression models showed that indebtedness, tangibility, total asset turnover ratio, current asset turnover ratio, receivables turnover ratio, GDP, and inflation significantly influence the profitability of agricultural enterprises, while liquidity, indebtedness, tangibility, total asset turnover ratio, GDP, and inflation impact the profitability of food enterprises.

## 3. METHODOLOGY

### 3.1. Sample selection

The sample includes small and medium-sized agricultural enterprises that operated in the territory of the Republic of Serbia from 2014 to 2021. After a detailed analysis and removal of companies with missing data, companies with outliers, and companies that did not operate during the period specified for this research, the sample comprised 220 enterprises. The data were obtained from financial reports available on the website of the Business Registers Agency of the Republic of Serbia.

### 3.2. Variables

As the dependent variable, or the indicator of profitability, the Return on Assets (ROA) was used, while various internal and external indicators were observed as independent variables. For internal determinants of profitability, different financial indicators were used, calculated based on data from the companies' financial reports. As external determinants, GDP and inflation (CPI) were utilized (Table 1).

**Table 1:**List of variables

Variable	Notation	Measurement	Predicted sign
Return on assets	ROA	Net income/Average total assets	/
Financial leverage	LEV	Total liabilities/Total capital	+/-
Size	SIZE	logTotal assets	+/-
Liquidity	LIQ	Current assets-Inventories/Short-term liabilities	+/-
Tangibility	TANG	Fixed assets/Total assets	+/-
Total asset turnover ratio	TOAT	Sales revenue/Average total assets	+/-
Gross domestic product	GDP	Growth rate of gross domestic product	+/-
Inflation	CPI	CPI growth rate	+/-

Source: Author's calculation

### 3.2. Method

To evaluate the influence of internal and external determinants on the profitability of small and medium-sized agricultural enterprises, we will employ panel regression analysis. In econometrics and statistics, panel data, also known as longitudinal data or a combination of time series and cross-sectional data, refer to data sets that include repeated observations of a selection of observation units across both time and space dimensions.

Initially, the formulated model's fundamental assumptions for the application of panel data were examined, including tests for multicollinearity, heteroskedasticity, autocorrelation, and the dependence of cross-sectional data, in order to select the final model specification.

To investigate the impact of internal and external determinants on the profitability of small and medium-sized agricultural enterprises, regression models were formed with the following structure:

$$ROA_{it} = \beta_{it} + \beta_1 LEV + \beta_2 SIZE + \beta_3 LIQ + \beta_4 TANG + \beta_5 TOAT + \beta_6 GDP + \beta_7 CPI + u_{it}$$

where i represents each company (i = 1,2,3,...,220), and t represents each year (t = 1,2,3,...,8).

## 4. RESULTS AND DISCUSSION

In the following table, the results of the descriptive statistical analysis for the variables used in the panel regression model are presented (Table 2).

**Table 2:** Descriptive statistics for business indicators used in the panel regression model

Variable	Median	Minimum	Maximum	Standard deviation	Coefficient of variation
ROA	2.32	-13.67	250.33	0.50	38.39
LEV	0.61	0.00	136.91	7.04	2.76
SIZE	2.46	0.48	6.99	1.65	0.54
LIQ	1.33	0.00	5117.60	124.14	16.34
TANG	0.41	0.00	140.97	4.87	6.52
TOAT	0.80	0.00	1334.60	58.75	14.49
GDP	2.10	-1.60	7.50	2.78	1.06
CPI	2.00	1.10	4.10	0.92	0.43

Source: Author's calculation

The median value of the ROA indicator, during the observed period, was 2.32%. A median ROA value of 2.32% for the observed agricultural enterprises indicates a very low level of profitability for these companies, as it is generally considered that enterprises are profitable if they achieve an ROA value above 5%. The standard deviation of the ROA indicator is very high, suggesting significant differences between individual enterprises in the sample. The median value of financial leverage is 0.61, indicating a dominant participation of capital in liabilities. The size of the enterprises, measured by the logarithm of total assets, has a median value of 2.46, with a somewhat lower degree of variation, which is expected as the sample only includes small and medium-sized enterprises. The median value of the liquidity indicator is 1.33, which is above the usual norm for this indicator of 1. It can be noted that the liquidity indicator has the highest variability compared to all other observed indicators. The median value of the tangibility is 0.41, meaning that fixed

assets constitute 41% of the total asset value. The median value of the total business asset turnover ratio is 0.80, indicating that the total assets are turned over only once a year through sales revenue. The minimum value of total asset turnover is 0, which is expected in insolvent companies, and the maximum value is 140.97. Gross Domestic Product (GDP) and inflation are usually interpreted on an annual basis but not per individual companies, so each company was assigned the same value of these indicators for each year. The median value of the GDP during the observed period was 2.1%, and the average inflation rate was 2.0%. The lowest GDP rate was recorded in 2014 at -1.6%, and the highest in 2021 at 7.5%. The lowest inflation rate was recorded in 2016 (1.1%), and the highest in 2021 (4.1%).

For the variables featured in the panel regression model, an initial check for multicollinearity among the independent variables was conducted (Table 3).

**Table 3: Multicollinearity testing**

Variable	VIF	TOL
CPI	1.33	0.75
GDP	1.33	0.75
LEV	1.21	0.83
TANG	1.12	0.89
SIZE	1.09	0.91
LIQ	1.00	0.99
TOAT	1.00	0.99

**Source:** Author's calculation

Based on the results of the Variance Inflation Factor (VIF) and the Tolerance (TOL, which is 1/VIF) coefficients, it can be observed that for none of the variables is the VIF value greater than 10, nor is the TOL value below 0.1. Therefore, it can be concluded that there is no problem of multicollinearity in the formed model.

In the next step, tests were conducted to check for the presence of heteroskedasticity, autocorrelation, and cross-sectional dependence of data (Table 4).

**Table 4: Tests of heteroskedasticity, autocorrelation and cross-sectional dependence**

Test	Test statistics	p-value
Breusch-Pagan/Cook-Weisberg test	3,210.12	0.00
Wooldridge test	82.57	0.00
Pesaran's CD test	57.58	0.00

**Source:** Author's calculation

To test for the presence of heteroskedasticity, the Breusch-Pagan / Cook-Weisberg test for heteroskedasticity was applied. Based on the results of this test, it can be noted that at the 1% significance level ( $p < 0.01$ ), the null hypothesis of homoskedasticity is rejected and the alternative hypothesis of the existence of heteroskedasticity is accepted. The presence of autocorrelation was tested using the Wooldridge test, and autocorrelation was confirmed to be present at the 1% significance level ( $p < 0.01$ ). The results of the Pesaran CD test indicate that there is a statistically significant dependency in cross-sectional data ( $p < 0.01$ ), suggesting the existence of common factors that influence the dependent variable.

In accordance with the results indicating a violation of the initial assumptions of the panel model, it is not feasible to use the classical Hausman test. Instead, a modified version of this test is applied. The results of the Hausman test statistics at 27.088 ( $p = 0.016$ ), indicate that at the 5% significance level, the null hypothesis is rejected and the alternative hypothesis is accepted, leading to the selection of the fixed effects model.

Due to the compromised assumptions of the panel model, specifically the identified presence of heteroskedasticity, autocorrelation, and cross-sectional dependence of data, an alternative specification of the fixed effects model was employed (Table 5). This alternative represents a model with panel-corrected standard errors (PCSE - linear regression with panel-corrected standard errors).

**Table 5: Estimated model of fixed effects for the profitability of small and medium-sized agricultural companies from Republic of Serbia (2014-2021)**

Variable	Coefficient	Standard error	t-statistics	p-value
Constant	-0.0779	0.0415	-1.878	0,0617
LEV	-0.0046	0.0024	-2.902	0.0485
SIZE	0.0285	0.0134	2.135	0.0339
LIQ	-0.0023	0.0001	-1.622	0.1063
TANG	0.0028	0.0001	2.801	0.0431
TOAT	0.0001	0.0001	2.819	0.0053
GDP	0.0030	0.0037	0.0814	0.4238

CPI	0.0022	0.0101	0.2223	0.8243
n	220			
t	8			
N	1760			
R <sup>2</sup>	0.5780			
F-test	9.9459			
p-value (F)	0.000			

Source: Author's calculation

The panel regression model was formed based on data from 220 companies over an 8-year period, resulting in a total of 1760 observations. From the F-test results, it can be concluded that the formed model is highly statistically significant ( $p < 0.01$ ). The coefficient of determination reveals that 57.8% of the variability in the return on assets rate is explained by the influence of the examined factors. The indicator with a statistically significant ( $p < 0.05$ ) and negative impact on profitability is financial leverage, suggesting a slight decrease in profitability by 0.005% with a 1-point increase in this indicator. Similar findings, i.e., a negative impact of financial leverage on profitability, were reported in the studies by Andrašić (2018), Sensini (2020), and Xu et al. (2021). The size of the company also showed a statistically significant impact ( $p < 0.05$ ) on the profitability of the observed agricultural companies. An increase in company size can be expected to lead to an increase in profitability, a finding consistent with Jacob and Collins (2016), who analyzed agricultural companies in Kenya. Tangibility also had a positive and statistically significant impact on the profitability of the observed companies ( $p < 0.05$ ), suggesting that fixed assets in these companies are used effectively to increase profitability. Another indicator determined to significantly ( $p < 0.05$ ) influence profitability is the total business assets turnover ratio. The positive impact of this indicator on profitability, as indicated by the regression coefficient, confirms the results obtained by Sensini (2020), Milašinović and Mitrović (2020), and Tekić et al. (2022).

## 4. CONCLUSION

From the examination of profitability among small and medium-sized agricultural enterprises in the Republic of Serbia, for the period from 2014 to 2021, the research results have determined that the average profitability of the observed companies was 2.32%. Using panel regression analysis, the impact of internal and external determinants on the profitability of these companies was investigated, and it was noted that financial leverage, company size, tangibility, and the total business asset turnover ratio had a statistically significant impact on profitability. Financial leverage had a negative impact on profitability, which can be attributed to the high level of indebtedness of these companies, suggesting that future additional borrowings should be avoided. Company size had a positive and statistically significant impact on profitability; being measured by the logarithm of total assets, it can be concluded that as assets increase, so does the profitability of the company, indicating that medium-sized companies are more profitable. Tangibility also stood out as a significant determinant with a positive impact on profitability, which can be seen as effective utilization of existing fixed assets. The total business asset turnover ratio also had a statistically significant and positive impact on profitability. The research results also revealed that none of the observed external determinants had a statistically significant impact on profitability. These findings could be particularly valuable in the future for managers of agricultural companies, guiding them towards profitability-oriented management, as well as for policymakers in agricultural policy who can glean insights into the strengths and weaknesses of the agricultural sector based on these results.

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### **Željana Ivošević**

University of Novi Sad, Faculty of Economics  
 Subotica, Student  
 Subotica, Serbia  
 ivoseviczeljana@gmail.com

### **Boris Radovanov**

University of Novi Sad, Faculty of Economics  
 Subotica  
 Subotica, Serbia  
 boris.radovanov@ef.uns.ac.rs

### **Aleksandra Marcikić Horvat**

University of Novi Sad, Faculty of Economics  
 Subotica  
 Subotica, Serbia  
 Aleksandra.marcikic.horvat@ef.uns.ac.rs

## **EFFICIENCY ANALYSIS OF AGRICULTURAL PRODUCTION IN THE EUROPEAN UNION**

**Abstract:** In this paper authors examine relative technical efficiency of agricultural production in the European Union using Data Envelopment Analysis (DEA). Output oriented DEA model with variable return to scale has been applied. Four input variables were used in the model: labour, pesticides, fertilizers and used land. Production has been used as the only output variable. Results of this analysis indicate that the efficiency score values lie between 9% and 100%, with the average efficiency score of 52%. Slovenia, Estonia, Germany and Malta are characterized with the highest efficiency scores, while Cyprus, Finland and Ireland have the lowest efficiency score values. Policymakers can utilize this paper's findings to determine what elements enhance or diminish agriculture's efficiency.

**Keywords:** Technical efficiency, Agricultural production, Data Envelopment Analysis

### **1. INTRODUCTION**

In the past few decades, being able to increase productivity and efficiency has become really important for making the economy better, both for individual businesses and for the country as a whole. Hence, different ways of measuring efficiency are used. The implications of measuring efficiency are reflected in the competent indicators of the position of agricultural production in one country comparing with the others in the observable sample.

The liberalization process made it easier for people to find more chances for success and bigger rewards in a market that has a lot of competition (Bojnec et al. 2012). Previous studies showed that agricultural production in Central and Eastern Europe is not as effective as in the original EU member countries (Nowak et al. 2015). Nevertheless, prior studies have shown that agriculture in EU countries has been becoming less efficient over time (Kocisova 2015). Furthermore, there is still a big difference between the new countries in the EU and the original 15 countries, especially in terms of labour productivity (Matkovski et al. 2016). This can be partly explained by the different ways these two areas specialize in different things. Central and Eastern European countries mainly focus on making products from grains and raw materials, while in the EU15, they make more products from animals and process them, which makes more money for each worker (Csaki and Jambor 2019).

During the period of accession to EU integration, there was a big increase in the trade of agricultural and food products with other countries, because their markets became more open via market liberalization process. Making productivity improvement takes time because it takes time to complete structural changes and makes agricultural policy adjustments (Erjavec et al. 2014). Therefore, in this study we investigated opportunities to increase the efficiency of agricultural production in the EU countries. In order to perform such an analysis a Data Envelopment Analysis has been applied, as one of the most commonly used tools for assessing efficiency. Applying such a powerful tool can contribute to a better understanding of the agricultural situation in the observed set of EU countries (Marcikic Horvat et al. 2020).

## 2. METHODOLOGY AND DATA

A well-known nonparametric method for analysing the efficiency of particular Decision Making Units (DMU) is Data Envelope Analysis (DEA). This method, in contrast to parametric statistical approaches, compares, not the mean value, but the efficiency of each DMU with the greatest efficiency score in the sample. The application of DEA methods is possible in numerous and diverse activities of the economy, if the goal is to assess the efficiency and performance of the observed DMUs. A prerequisite for starting the analysis is the careful selection of adequate inputs and outputs. The next step is the selection of the model to be used in the analysis. DEA models can be used in efficiency assessment, identification of inefficiencies, comparative analysis, benchmarking, sensitivity analysis, scenario analysis and for optimal resource allocation. Efficiency assessment refers to the analysis of different DMUs that can be related to different countries, regions, companies, etc. Similar to efficiency assessment, inefficiency identification shows the opposite results, i.e. it shows inefficient DMUs. This type of analysis is most often used within some complex systems and organizations, with the aim of identifying inefficiencies and taking corrective actions in order to completely eliminate or minimize them. Companies often use a method called benchmarking or comparative analysis. It refers to performance measurement based on a predetermined indicator. It is most often applied when comparing with a competing company or comparing with successful companies in another branch, with the aim of determining the market situation in which the company is currently located. Also, in addition to the external benchmarking analysis, the company can opt for an internal analysis, where the internal segments of the company are compared using different parameters. A sensitivity analysis can also be performed using the DEA method. Within this analysis, the impact of changes in parameter values within the observed variants is evaluated. The goal is to determine the impact of changed input or output values on efficiency. Scenario analysis is mainly used with hypothetical scenarios, where different outcomes in different situations are analyzed. This analysis is about forecasting, that is, the future. During the analysis, different scenarios are created in which adjustments and changes in input and output values are made, in order to understand the possible effects on efficiency. Based on the results of the analysis, the company can make a business decision more easily, given that it has insight into the most effective.

Resource allocation is an extremely useful type of analysis in which the DEA method can also be applied. In this way, an adequate allocation of resources can be determined while at the same time expecting maximum results, i.e. improvement of overall efficiency.

In our study, the output-oriented BCC model has been used to calculate and compare the relative technical efficiency of agricultural production in the EU countries in 2021. The DEA is carried out by solving the following model (Banker et al. 1984) of linear programming:

$$\begin{aligned}
 & \max \phi \\
 \text{s. t. } & \sum_{j=1}^n x_{ij} \lambda_j \leq x_{i0} \quad i = 1, 2, \dots, m; \\
 & \sum_{j=1}^n y_{rj} \lambda_j \geq \phi y_{r0} \quad r = 1, 2, \dots, s; \\
 & \sum_{j=1}^n \lambda_j = 1 \\
 & \lambda_j \geq 0
 \end{aligned} \tag{1}$$

where  $n$  is the number of DMUs, and  $DMU_0$  represents the country under evaluation. Assume that we have  $s$  output variables and  $m$  input variables. Observed output and input values are  $y_r$  and  $x_i$  respectively, thus  $y_{r0}$  is the amount of output  $r$  used by  $DMU_0$ , while  $x_{i0}$  is the amount of input  $i$  used by  $DMU_0$ .  $\lambda$  is the DMU's weight and the efficiency score is  $\phi$ .

Data on agricultural production for 27 EU countries are presented in the Table 1. Inputs are given through the columns of pesticides, fertilizers, land used and labor. Pesticides and fertilizers provide information on their use in agricultural production in 2021, for each country separately. Used land refers to hectares of agricultural land on which agricultural production is based, while labor force refers to the number of employed workers in agriculture in 2021. The produced quantities are expressed in tons and refer to the total quantity of produced agricultural products in 2021. The data on the produced quantities represent the value of the output in the DEA model.

**Table 1:** Initial data of agricultural production of EU countries in 2021

Country	Pesticides (t)	Fertilizers (t)	Used land in 000 ha	Labour	Production (t)
Austria	5862	169676.76	25974594	160820	10835900
Belgium	5709.67	230006.28	1365.67	45430	14083650
Bulgaria	4484	458771.93	50465972	193570	15168812
Croatia	1463	178324	1476	113780	6214610
Cyprus	1115.4	14786.93	1231349	12320	345597
Czechia	3461.1	367895	3529797	132940	14789940
Denmark	2975.53	312589.18	2618	59020	14644410
Estonia	885.92	72446	987	17560	1677400
Finland	4032.4	220003	2268	104710	3988760
France	69602.42	2753165	28553754	675950	131994961
Germany	49071.47	1517184	16591	517350	421298606
Greece	4766.65	319715.11	5867188	446020	13269350
Hungary	8858.11	669848	50436886	203900	19582410
Ireland	3090.94	713772.36	4337	106420	3092080
Italy	50345	958218.41	124030309	913470	51819600
Latvia	1984.43	152292	1970	58870	3694400
Lithuania	2590.5	318341	2937.8	72710	7829200
Luxembourg	122.71	14180.88	132811	3330	187600
Malta	70.76	1159.54	27607	2150	56760
Netherlands	11291.6	275177	1812	205070	20929690
Poland	26534	1729000	14499.46	1390530	70189140
Portugal	9583.2	169688.26	39622955	130560	8100318
Romania	5598	922487	13079	911410	39742730
Slovakia	1620	178338.58	1856	62600	6846880
Slovenia	931	44578	610.96	39160	1019047
Spain	76173.55	1860154.94	262284464	802730	73217521
Sweden	1858.9	296933	3002.91	99610	8711890

Source: Food and Agriculture Organization of the United Nations

Based on initial data on agricultural production in EU countries, a descriptive statistical analysis was performed where the minimum and maximum values, average parameter values and standard deviation were determined. The data are shown in Table 2 and allow insight into the structure and main features of the analyzed data.

**Table 2:** Descriptive statistics of agricultural production of EU countries in 2021

Indicator	Pesticides (t)	Fertilizers (t)	Used land in 000 ha	Labour	Production (t)
Min	5862	1159.54	610.96	2150	56760
Max	76173.55	2753165	262284464	1390530	421298606
Average	13114.16	552545.64	21934336.92	277110.74	35678935.63
St. Dev.	21623.94	675953.94	55256616.87	358429.47	82603018.43

Source: author's calculations

### 3. RESULTS AND DISCUSSION

In order to evaluate the technical efficiency of agricultural production in European countries, the MaxDEA software has been used. In this case, the output orientation of the DEA model was selected and the technical efficiency was assessed using BCC model with variable return to scale. Based on the results shown in the Table 3, we can conclude that four countries (Estonia, Germany, Malta and Slovenia) achieved the highest possible efficiency of agricultural production in the year of 2021. The average efficiency score is 0,52 which shows that there is room to improve efficiency of

agricultural production in the EU countries. The lowest efficiency score values are achieved by Cyprus, Finland, Ireland, Portugal and Spain.

**Table 3:** Technical efficiency of agricultural production of EU countries in 2021

Country	Efficiency Score	Rank
Austria	0.231137	21
Belgium	0.864883	7
Bulgaria	0.399223	14
Croatia	0.918719	5
Cyprus	0.089923	27
Czechia	0.506465	12
Denmark	0.729699	10
Estonia	1	1
Finland	0.136921	26
France	0.313305	18
Germany	1	1
Greece	0.328241	16
Hungary	0.259032	20
Ireland	0.144376	25
Italy	0.194822	22
Latvia	0.324881	17
Lithuania	0.465839	13
Luxembourg	0.372699	15
Malta	1	1
Netherlands	0.641882	11
Poland	0.310443	19
Portugal	0.172773	24
Romania	0.885823	6
Slovakia	0.835115	8
Slovenia	1	1
Spain	0.17379	23
Sweden	0.829931	9

Source: author's calculations

Countries that achieved efficiency score below 1 may improve their efficiency levels by raising the level of agricultural production (output) with the constant level of the input variables. Thus, in addition to the information on efficiency score, DEA also provides useful information for decision makers on possible ways of efficiency improvement which are presented in the Table 4. Data in the Table 4 presents the projected (ideal) values of the DEA model variables that should maximise the overall efficiency of the sample.

**Table 4:** Results of DEA model – Projections

Country	Projection (Pesticides)	Projection (Fertilizers)	Projection (Used land)	Projection (Labour)	Projection (Production)
Austria	5517.54773	169676.76	26382.49094	59418.25261	46880875.78
Belgium	2619.659616	110757.2741	1365.67	45430	16283873.13
Bulgaria	4484	137700.0062	26614.84596	48551.39394	37995829.95
Croatia	1463	89222.02392	1476	23467.42664	6764432.905
Cyprus	511.2224088	14786.93	27507.97829	6781.080509	3843260.199
Czechia	3461.1	106052.6807	26844.80726	37796.48692	29202318.91
Denmark	2975.53	133435.4591	2618	38986.95954	20069114.55

Estonia	885.92	72446	987	17560	1677400
Finland	4032.4	166329.6382	2268	50128.1105	29131749.65
France	49071.47	1517184	16590.99998	517350	421298606
Germany	49071.47	1517184	16591	517350	421298606
Greece	4766.65	146444.8655	26551.30256	51523.21373	40425672.45
Hungary	8858.11	273029.8361	25631.48889	94541.36984	75598513.08
Ireland	3090.94	133965.5185	4337	39748.9707	21416820.5
Italy	31004.66996	958218.41	20652.65273	327393.2549	265984689.1
Latvia	1984.43	104289.3899	1970	28791.68484	11371531.88
Lithuania	2590.5	121116.6586	2937.8	34878.36252	16806674.51
Luxembourg	122.71	2766.812031	27595.32096	2696.209228	503355.8534
Malta	70.76	1159.54	27607	2150	56760
Netherlands	4549.178058	155257.2417	1812	75100.16771	32606737.74
Poland	26534	832374.4857	14499.46	282239.9068	226093278.9
Portugal	5517.919431	169688.26	26382.40736	59422.16073	46884071.16
Romania	5598	195315.8487	13079	63701.12989	44865334.5
Slovakia	1620	93355.76158	1856	25010.7068	8198731.227
Slovenia	931	44578	610.96	39160	1019047
Spain	49071.47	1517184	16591	517350	421298606
Sweden	1858.9	98654.95497	3002.91	27211.92824	10497119.77

Source: author's calculations

## 4. CONCLUSION

Agricultural production is an economic branch that has many benefits from different aspects. One of the most important is, of course, ensuring food security. Food security refers to the provision of sufficient food for the entire population. Within the European Union, there are significant differences regarding the volume of agricultural production, that is, the amount of agricultural products produced. Some countries have more developed agriculture and the entire agribusiness sector, while on the other hand there are countries that do not have the opportunity to reach an enviable level of agricultural production.

Natural resources and weather conditions have the greatest influence on the success of agricultural production. Countries like France, Germany, Spain and Italy have extremely favourable conditions for carrying out agricultural production, while the same cannot be said for countries like Malta, Cyprus and Luxembourg. The mentioned countries have limited arable land and climatic conditions that do not suit many agricultural crops. The advantage of the EU is the facilitation of easier foreign trade exchange, where imports and exports take place freely between countries.

The positive impact of agricultural production is reflected in the strengthening of the national economy, where through the export of agricultural products to foreign countries, it is possible to obtain foreign currency, which creates an inflow of funds into the budget. This enables the expansion of the number of jobs and many other benefits.

Finding opportunities to increase the efficiency of agricultural production in the EU countries was the major goal of this article, which focused on research into the technical efficiency of agriculture and its sources of inefficiency. More precisely, policymakers can utilize this paper's findings to determine what elements enhance or diminish agriculture's efficiency. This research can also help farmers, as their choices on how to use inputs and outputs are critical to the efficiency of agriculture.

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**Sanja Džever**

University of Novi Sad,  
 Faculty of Economics in Subotica  
 sanja.dzever@ef.uns.ac.rs

**Dunja Kostić**

University of Novi Sad,  
 Faculty of Economics in Subotica  
 dunja.kostic@ef.uns.ac.rs

**Dražen Marić**

University of Novi Sad,  
 Faculty of Economics in Subotica  
 drazen.maric@ef.uns.ac.rs

**Ksenija Leković**

University of Novi Sad,  
 Faculty of Economics in Subotica  
 ksenija.lekovic@ef.uns.ac.rs

## **GENERATION Z ATTITUDES TOWARDS ORGANIC FOOD: A REVIEW**

**Abstract:** The global food market is continuously undergoing rapid and complex changes, creating a dynamic environment that demands constant adjustments and responses. Thus, the food industry has been increasingly popular nowadays as a research topic. Furthermore, academic researchers are notably interested in analyzing greater demand for organic food, particularly in developed countries. Despite the barriers that consumers encounter in the market, a growing percentage of them are currently shifting to organic purchases. Consequently, most of the research studies aim to understand consumer behavior since it is crucial for businesses and policymakers seeking to promote sustainable food systems. Consumer choices concerning food have a significant impact on the environment, as they are drivers of agricultural production. Despite the fact that Generation Z consumers will be the head of their households in the near future, little is known about their behavior. Therefore, the subject of this paper is organic food, with a special emphasis on Generation Z attitudes. The research gap is particularly concerning given that Generation Z is likely to embrace a lot of new trends on the market. Thus, this paper aims to define recommendations for further research on the topic in order to minimize the noticed research gap. Through a systematic literature review, the paper examines a total of five empirical studies published in the last four years.

**Keywords:** generation Z, consumer behaviour, organic food.

### **1. INTRODUCTION**

Over the last two decades, there has been a significant rise in the consumption of organic food worldwide, while leading the way are the United States, Germany, France, and Australia (Pawar et al., 2022). In accordance with ecological standards, organic agriculture is deemed the most favorable form of farming nowadays (Palić et al., 2019.) Except for the health-related motives, organic food consumption is mostly associated with individuals who are open to new experiences.

The specified characteristic is commonly related to Generation Z (Gen Z), also known as Post-Millennials. Thus, this young generation has been identified as a promising market segment for sustainable strategies (Su et al., 2019). The emerging generation is expected to have a crucial influence on the political, economic, and social landscapes of nations in the foreseeable future (Aydemir et al., 2023). Therefore, the subject of this paper is organic food, with a special emphasis on Gen Z attitudes.

Since the consumers' attitudes are formed through the multiplication of beliefs with evaluations (Aertsens et al., 2009), it is possible to predict Gen Z's behavioral intention toward organic food consumption. However, a systematic literature review has identified the research gap. The research gap is alarming given that Gen Z consumers are currently developing their decision-making processes by moving out from their parent's homes (Kymäläinen et al., 2021). Thus,

this paper aims to define recommendations for further research on the topic in order to minimize the noticed research gap.

Hence, the first part of the paper starts with an introduction that presents a detailed explanation of the subject, problem, and aims. Furthermore, the second part gives an overview of the relevant domestic and foreign literature, aimed at supporting the theoretical explanation of the topic. The subsequent parts focus on a systematic approach to analysis and comparative analysis of research frameworks. The research findings, limitations, and recommendations for further research on the topic are presented in the conclusion section.

## 2. LITERATURE REVIEW

The world is currently facing a major threat in the form of environmental degradation and climate change. In the context of the food market, this situation requires the collective effort of all stakeholders and policymakers to transform the food system sustainably. Therefore, policies that encourage consumers to make more sustainable choices have been implemented (Aschemann-Witzel & Zielke, 2017). In line with the food industry facing a dynamic environment, the global food market has been going through a lot of changes trying to keep up with the developments (Vukasovič, 2013). The authors Schleenbecker & Hamm (2017) have noticed a discernible trend toward organic positioning, with a growing number of consumers increasingly expecting companies to place a high priority on sustainability across all aspects of their operations and product offerings. This shift in consumer demand is a positive indication of a heightened awareness of the importance of environmental responsibility.

The term "organic" was recognized in the 1990s, as the system for producing food by propulsion of certain governments. As a result of rising consumer awareness, it has gained prominence in the food industry years later (Rana & Paul, 2020). The authors Scalco et al. (2017), define the term "organic" as an environmentally friendly agricultural system that uses sustainable energy sources, considers the well-being of animals, and preserves the soil. In other words, organic production processes are unique sets of practices that prioritize the use of natural methods to produce food. These methods include the restriction of veterinary medicine, growth regulators, artificial pesticides, etc. Additionally, these methods include the improvement of livestock diversity, their rotation, energy/material recycling, etc. (Brantsæter et al., 2017). Thus, the scientific literature identifies several terms that are often associated with organic products: fresh, local, natural, pure, etc. (Rana & Paul, 2017). As per the findings of Kushwah et al. (2019), organic food is recognized by consumers as a form of eco-innovation or sustainable innovation on a global scale.

According to the authors Chen & Antonelli (2020), consumers' food purchasing habits are influenced by various factors such as physical activity levels, biological needs, lifestyle, but also the natural environment. Consequently, there is a noticeably greater demand for organic food products around the world (Li et al., 2020). Also, consumers' food preferences have a substantial influence on the environment, as they are instrumental in driving agricultural production (Kamenidou et al., 2019). Therefore, the scientific community is interested in analyzing the positive as well as the negative impacts on consumers' purchase intentions (Kushwah et al., 2019). The comprehension of factors that impact consumers' decision-making process has the potential to aid producers, processors, and sellers in creating effective marketing strategies and better approaches to the target groups (Massey et al., 2018).

The authors Monier-Dilhan & Bergès (2016) state that health-related factors are majorly the primary motive for choosing organic food, mostly followed by deep concern about the environment and taste. In line with that, the author Bryla (2016) has found that organic food buyers are much more frequently impacted by product safety and product taste, while non-organic food buyers are much more frequently impacted by advertising and curiosity. However, the authors Husic-Mehmedovic et al. (2017) state that self-identity motivators also play a significant role in consumers' decisions. The concept of self-identity motivators suggests that a person's identity impacts their food choices. In other words, organic food consumption can help them identify themselves as environmentally responsible consumers (Lazaroiu et al., 2019). Also, the authors Djokic, et al. (2018) have observed that organic food consumers are primarily individuals who are classified as "adventurers" based on their lifestyles. Although this production system has gained global recognition for its numerous benefits, consumers still encounter specific obstacles when it comes to purchasing (Kushwah et al., 2019).

The authors Katt & Meixner (2020) state that organic labeled products are usually much more expensive than conventional. Also, the authors Kutnohorská & Tomšík (2013) state that the high price barrier is followed by limited product offers, consumers' satisfaction with non-organic food, and the lack of perceived value. Even though described motives and barriers to organic purchasing have been mostly analyzed in the global food market, socio-demographic factors are also affecting food choices. Thus, the authors Aydemir et al. (2023) state that it is crucial to important to determine the food preferences of age groups.

Generation Z (Gen Z) has been becoming the most significant lately, but the scientific literature also identifies several generations that coexist: Boomers, Generation X, Millennials, and Generation Alpha (Manghiuc & Petrescu, 2020). Gen Z consumers are born in the mid-to-late 1990s and the early 2010s (Kymäläinen et al., 2021). They are characterized by a seeking for a high level of education, technological proficiency, and a strong commitment to the community (Su et al., 2019). Also, Gen Z consumers are renowned for their inclination toward creativity, innovation, and for demonstrating exceptional proficiency in online searches and research. They possess an enviable ability to gather information on

diverse topics with ease, which makes them an invaluable age group in today's information-driven world (Grigoreva et al., 2021). Therefore, Gen Z is far more informed about sustainable living than prior generations (Su et al., 2019). Research attention should be especially given to Generation Z consumers since most of them are starting their family-independent life arrangements and creating new consumption habits (Kamenidou et al., 2019).

### 3. A SYSTEMATIC APPROACH TO ANALYSIS

Given the research gap, this paper examines a total of five empirical studies published in the last four years (Nguyen & Vo, 2023; Julianty et al., 2021; Bhutto et al., 2023; Vehapi & Sabotic, 2021; Vehapi & Mitić, 2021). Each of the five empirical studies has shown a tendency to be highly ranked according to different criteria and journal scores in Foundations of Management, 2nd International Seminar of Science and Applied Technology (ISSAT 2021), PLOS ONE, Marketing, and Ekonomika poljoprivrede journal.

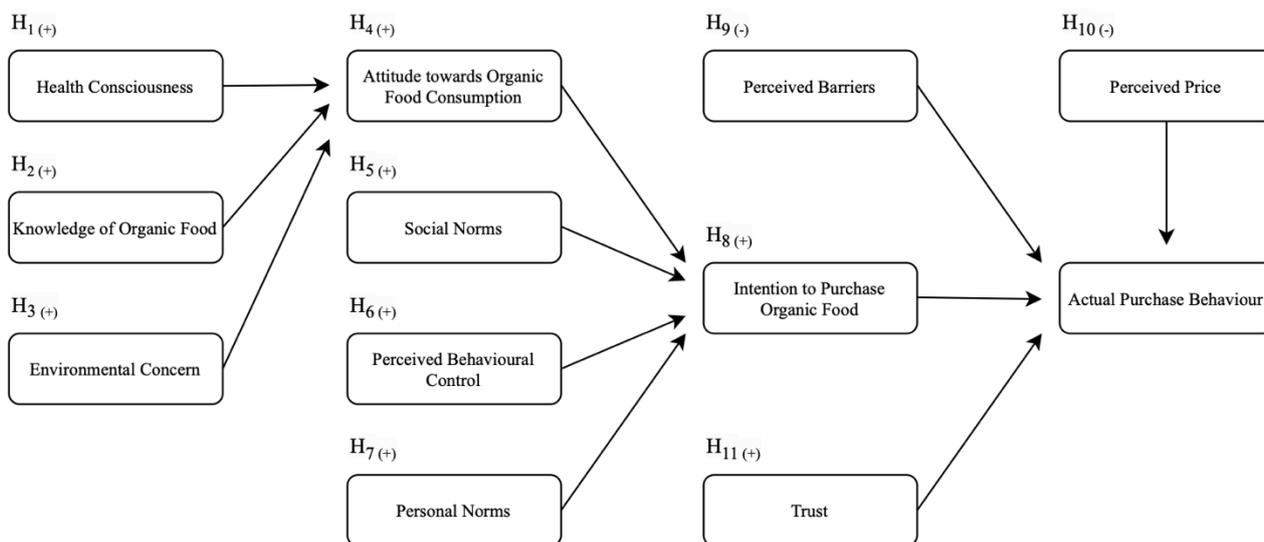
Regarding the aim of this paper, the following keywords have been investigated: generation Z, consumer behavior, and organic food.

For further comparative analysis of Generation Z attitudes towards organic food research frameworks, these studies have been reviewed by the content, methodology, and major findings.

### 4. COMPARATIVE ANALYSIS OF RESEARCH FRAMEWORKS

In the first empirical study, the authors Nguyen & Vo (2023) investigated “the predictors of purchase behavior of Generation Z in the Vietnamese organic food sector. A research framework was proposed by extending the theory of planned behavior (TPB) with the motivation–opportunity–ability (MOA) framework to address the gap between purchase intention and behavior in the organic food market. An online questionnaire was conducted in the three biggest cities of Vietnam, and after 426 respondents filled it in, the data were analyzed in SmartPLS software to test proposed hypotheses.” (p. 35)

**Illustration 1: Research framework 1**



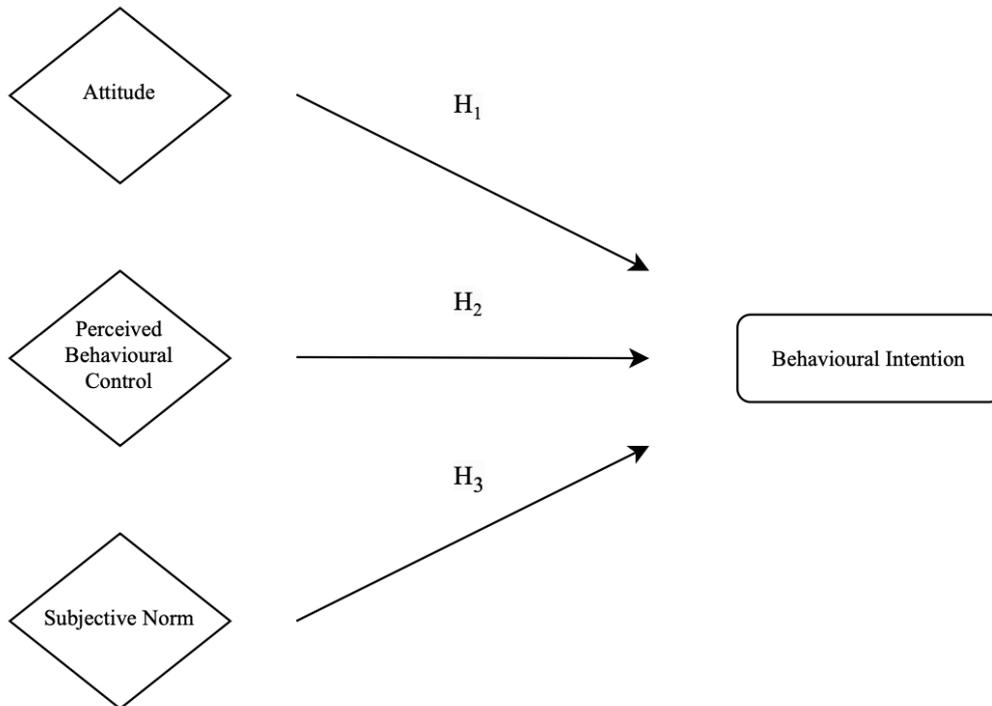
**Source:** The authors' research based on Nguyen & Vo, 2023.

The authors found that “trust is the most crucial factor affecting the purchase behavior of Gen Z in the Vietnamese organic food sector. Also, they discovered that perceived barriers had a reverse impact on the purchase behaviors of young consumers. Regarding the MOA model, the study confirmed that ability (e.g., attitude, intention, social norms, and personal norms) and motivation (e.g., trust) are more important predictors of purchase behavior than the opportunity (e.g., perceived price)” (p. 46)

In the second empirical study, the authors Julianty et al. (2021) investigated “Generation Z's behavioral intention towards organic food consumption in Indonesia through an online questionnaire. The respondents had to be young people between 15 and 24 (Gen Z) and had consumed organic foods at least once in the last three months. A total of 250 responses were collected and analyzed by a quantitative approach using PLS-SEM to achieve the study's objectives. In

PLS-SEM, two stages were performed sequentially: the first stage was to measure the reliability and validity of the construct variables, while the second stage was to test the structural model.” (p. 595)

**Illustration 2: Research framework 2**

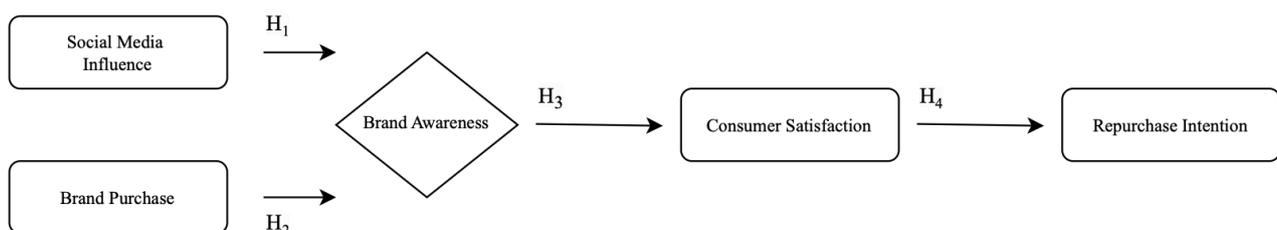


**Source:** The authors’ research based on Julianty et al., 2021.

The authors found “three notable findings responding to the study’s objective. First, the attitude of Indonesian Gen Z is positive and significant towards their behavioral intention on organic food consumption. This finding implies that Indonesian Gen Z has favorable behavior towards organic foods, so producers shall continually build Gen Z attitudes through various promotional media to get their positive attitude and intention towards organic foods. Second, Indonesian Gen Z exhibits the positive influence of perceived behavioral control on behavioral intention. This finding implies that it is not difficult for Indonesian Gen Z to perform behavior related to organic food consumption, so producers maintain good environments that can be perceived positively by the target customers. Third, Indonesian Gen Z subjective norms positively impact behavioral intention to consume organic food. It implies that Gen Z has an internal desire to act as others think related to organic foods as they are influenced by social environments. This finding proposes that producers of organic food are required to educate their customers to have a favorable subjective judgment on consuming organic foods.” (p. 597)

In the third empirical study, the authors Bhutto et al. (2023) investigated “the repurchase intention of organic food products among Generation Z consumers. An online questionnaire was conducted in Islamabad, Pakistan, and after 400 respondents filled it in, the data were analyzed using the PLS-SEM approach.” (p. 1)

**Illustration 3: Research framework 3**

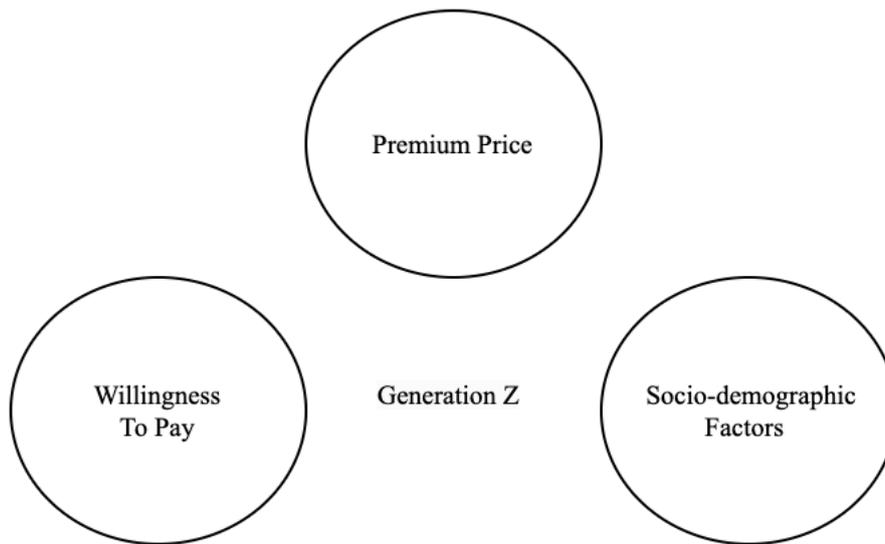


**Source:** The authors’ research based on Bhutto et al., 2023.

The authors found that “social media influence and brand purchase impact brand awareness and consumer satisfaction. Moreover, it is also found that consumer satisfaction positively impacts the repurchase intention of organic food. Also, they discovered that Gen Z has a strong social media influence, so marketers’ managers must consider and address the issues when consumers consider social media for their concerns and suggestions.” (p. 1)

In the fourth empirical study, the authors Vehapi & Sabotic (2021) investigated “the extent to which Generation Z consumers are willing to pay a premium price for organic food and to identify the socio-demographic factors which impact their willingness to pay. The study was carried out on a sample of 213 students in the Republic of Serbia, an emerging organic food market, via a structured questionnaire.” (p. 258)

**Illustration 4: Research framework 4**



**Source:** The authors’ research based on Vehapi & Sabotic, 2021.

The authors found that “more than 2/3 of the respondents who purchase organic food would pay a premium price of between 1% and 40%. Only 8% of the respondents are not willing to pay more for organic food products. The Chi-squared test for independence was used to analyze the relationship between socio-demographic characteristics of the respondents and their willingness to pay; it was determined that smaller households (1-3 members), as well as households in bigger cities, show a greater willingness to pay premium price for organic food.” (p. 258)

In the fifth empirical study, the authors Vehapi & Mitić (2021) investigated and identified “the main motives and barriers for purchasing organic food in the Generation Z market segment in Serbia. A quantitative study was conducted through a survey questionnaire filled out by 213 students from three universities. The results were based on descriptive statistics, the independent samples t-test, and the analysis of variance.” (p. 985)

**Table 1:** Research items 5

	<b>Motives</b>	<b>Barriers</b>
1	Quality	High price
2	Health protection	Lack of information
3	Absence of pesticides and GMO	Limited availability
4	Freshness	Limited offer
5	Taste	Mistrust in organic labels
6	Safety	Lack of interest
7	Support for the local/small farmers	Less appealing appearance
8	Environmental protection	
9	Animal welfare	
10	Preserving resources for future generations	

**Source:** The authors’ research based on Vehapi & Mitic, 2021.

The authors found that “quality and health protection and improvement are identified as the primary motives for purchasing organic food, proving that egoistic motives prevail over altruistic ones. The most important barriers hindering organic food consumption are high prices, lack of information, and limited availability. Also, they confirmed that the willingness of Generation Z members to accept high market prices for organic food depends on their monthly household income.” (p. 985)

## 5. CONCLUSION

The rising concerns of consumers regarding environmental sustainability and their health have led to an increased interest in organic products. This trend is primarily driven by the growing awareness of the negative impact of conventional farming practices on both the environment and consumers' health. The use of harmful pesticides, chemical fertilizers, and growth hormones in conventional farming poses a threat to the ecosystem and the health of consumers. As a result, they have gradually embraced organic products as a safer and healthier alternative. This trend is expected to continue as consumers become more informed and environmentally conscious (Massey et al., 2018).

Despite the organic trend consumers in the Republic of Serbia lack sufficient awareness regarding this topic, even though the domestic food is of high quality (Palić et al., 2019). However, Generation Z is the most informed generation regarding sustainable living which makes them a promising market segment. Also, they are beginning to live independently and develop new food consumption patterns (Kamenidou et al., 2019).

Even though Generation Z behavior plays a significant role in promoting supporting friendly practices and sustainable growth (Tigan et al., 2021) through a systematic literature review an empirical gap was observed. This paper aimed to analyze research frameworks of Generation Z attitudes towards organic food research studies.

In the first empirical study, the authors Nguyen & Vo (2023) found that trust is the greatest factor influencing Gen Z's purchasing behavior in the Vietnamese organic food market. In the second empirical study, the authors Julianty et al. (2021) found that Indonesian Gen Z has favorable behavioral intentions towards organic foods, impacted by perceived behavioral control and subjective norms. In the third empirical study, the authors Bhutto et al. (2023) found that Gen Z's consumer satisfaction and brand awareness in Pakistan are influenced by social media and brand purchase impact. In the fourth empirical study, the authors Vehapi & Sabotic (2021) found that only 8% of the respondents are not willing to pay more for organic food products in the Republic of Serbia, while more than 2/3 of the respondents who purchase organic food would pay a premium price of between 1% and 40%. Finally, in the fifth empirical study, the authors Vehapi & Mitić (2021) found that the most important barriers to purchasing organic food are high prices, lack of information, and limited availability, while quality and health protection and improvement are identified as the primary motives.

In the context of the topic, the limitation of this paper reflects the fact of the lack of empirical studies in both domestic and foreign literature. However, this review can also contribute the academic knowledge by providing a theoretical background of the topic and guidelines for further research.

Accordingly, the main recommendation for further research is conducting an empirical study on the attitudes of Generation Z towards organic food, based on a sample of a different socio-demographic profile. Thus, future research should provide unique insights into Gen Z consumers' behavior filling with additional findings the noticed research gap. Furthermore, the insights should be valuable for stakeholders and policymakers in the processes of transforming the food system sustainability.

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XXIX International Scientific Conference

**Strategic Management**and Decision Support Systems  
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**Sanja Titin**University of Novi Sad, Faculty of Economics  
in Subotica, Subotica, Republic of Serbia

e-mail: sanja.titin.t012023@student.ef.uns.ac.rs

**Rade Popovic**University of Novi Sad, Faculty of  
Economics  
in Subotica, Subotica, Republic of Serbia

e-mail: rade.popovic@ef.uns.ac.rs

## **APPROACHES TO MEASUREMENT SUSTAINABILITY OF AGRI-FOOD VALUE CHAINS**

**Abstract:** Globalization combined with recent extreme events (Covid-19, wars, sanctions, climate changes) yielded additional challenges to sustainability of agri-food chains on national levels. Contemporary approaches to agri-food value chains (AFVC) should be evaluated. The goal in this paper is systematic review of AFVC literature in several dimensions: applied concept, focused value chain, used methods, location of studies and key findings. Based on this research prevailing concepts and research methods will be defined, as a first step in further researching an AFVC in Serbia.

**Keywords:** agri-food, sustainability, value chains

### **1. INTRODUCTION**

The process of globalization in the food sector, through its history, generated an increasing effect on national AFVC levels. Although some are undeniably positive as: better food nutrition of world population, stability, and security of food supply worldwide, global increase in food production efficiency, etc. there are also opposite effects. One of negative sides of food globalization is high competitiveness pressure on national markets, sometimes with dumping prices, as result of strong export subsidies for excessive production from exporting countries. Farms and other companies in value chain increasing largely in size and makes AFVC fragile. National markets dependent on food or agricultural inputs import, facing Covid-19, wars or sanctions struggle with broken food supply, etc.

In recent decades, export bans introduced when nations were facing health or security issues, proved as a tool that hurts AFVC players. It was seen in case of: Ukraine, Russia, Serbia, and few other countries. With high stocks on the national market, prices of agricultural products fell below international level pushing farmers away from profit. In case of high inflation, food producers' and retailers' profits suffer from maximum prices introduced occasionally by the government for some basic food products.

Open markets are proven as more vulnerable and fragile in the case of AFVC. It is case with Serbia, participating in several free trade agreements. In recent decade Serbian farmers experienced strong price pressure especially in dairy and meat industry. Overproduction of agricultural and food products in some EU countries, in period of low international prices were subsidized in export. Very low prices were more than motivative for Serbian food importers. Consequently, the farm sector diminished livestock production to the level below self-sufficiency.

With such outside and sometimes inside pressures, AFVC on national level must improve their resilience to shocks. Institutional support in this process is essential. The first step, in deeper understanding of specific AFVC on national level, is making knowledge foundation from review of contemporary literature. The second step is to investigate and increase transparency, that will lead to the next step, better monitoring of AFVC.

## 2. METHODOLOGY

The research field encompasses an analysis of approaches to the sustainability of agro-food value chains (AFVC) at the national level, considering globalization and recent extreme events such as Covid-19, wars, sanctions, and climate changes. The methodology applied in this study is the PRISMA (Preferred Reporting Items for Systematic Reviews and Meta-Analyses) model as the methodological framework for the systematic review of literature on agro-industrial value chains. The first stage of the literature review involved selecting EBSCO Discovery Service and AgEcon Search as the primary source of information and determining key terms to aid in achieving the research goal.

The aim of the research is to develop conceptual framework from a systematic literature review of AFVC across various dimensions including applied concepts, focused value chains, utilized methods, study locations, and key findings. The search query applied was "AGRO FOOD VALUE CHAIN" AND "LITERATURE REVIEW." Keyword search was configured to cover titles, abstracts, and keywords in academic journals and e-books. Additionally, the search period was limited to documents published between 1990 and 2024, with only English language documents considered for the review process.

## 3. RESULTS

### 3.1. Concepts of value chain

The milestone in a concept of "value chain" created by Porter (1985), who defines it as a series of activities that a company undertakes to create value for the customer, starting from raw materials and extending to the delivery of the product or service to the end-user. The increasing focus on sustainability within the agricultural-food value chain necessitates precise analysis of concepts. To gain a better understanding and effectively track processes, it is crucial to have a deeper insight into the value chain.

A more detailed explanation, where the value chain describes the full spectrum of activities needed to bring a product or service from concept to final disposal after use, including different production phases (involving physical transformation and various producer services) and delivery to end consumers, was provided by Kaplinsky and Morris (2001). The concept of the value chain is widely understood, but it can be viewed from three perspectives. According to Da Silva, De Souza (2007) and Donovan et al. (2015), it can be seen as a series of activities that add value to a product from production to retail. Alternatively, it is viewed as a group of individuals or organizations linked along the chain, engaged in creating and modifying goods and services delivered to consumers. Thirdly, it is described as a strategic network of actors within the value chain collaborating within a broader institutional framework and utilizing support services. De Vries et al. (2022) define value chains as an integral part of strategic planning for many businesses today. The World Business Council for Sustainable Development (2011) defines a value chain as encompassing the entire life cycle of a product or process, including material sourcing, production, consumption, and disposal/recycling processes. In agriculture, a value chain identifies the set of actors and activities that bring a basic agricultural product from the field to final consumption, adding value at each stage of the production process. This value chain can take the form of a vertical link or a network among various independent business organizations involving processing, packaging, storage, transport, and distribution. The terms "value chain" and "supply chain" are often used interchangeably (World Trade Organization & OECD, 2013). The supply chain represents a network of organizations involved in various processes and activities that create value in the form of products or services directed towards the end user or consumer (Ballou, 2004). While the supply chain focuses on operational aspects of transportation and distribution, the value chain goes further by analyzing how each step in the process contributes to creating value for customers and the company as a whole.

### 3.2. Concepts of sustainability

Sustainability is the ability to maintain the balance of certain processes or conditions within a system. The most cited definition of sustainability and sustainable development, as set forth by the United Nations' Brundtland Commission (1987), is that "sustainable development is development that meets the needs of the present without compromising the ability of future generations to meet their own needs." This definition was further expanded by 2005, encompassing the respect for environmental, social, and economic needs - the "three pillars" of sustainability. The interest in the sustainability of agricultural and food systems stems from environmental concerns that emerged in the 1950s and 1960s. However, ideas about sustainability date back to ancient times, to the earliest written records from China, Greece, and Rome (Pretty, 2008). This history underscores the continuity and significance of the sustainability concept across centuries and diverse cultures.

Sustainability in agriculture is a dynamic concept that encompasses ecological, social, economic, and resource aspects that may vary over time, location, society, and priorities. According to Wichaisri, Sopadang (2018), for businesses, sustainability is becoming a fundamental principle.

### 3.3. Sustainability of AFVC

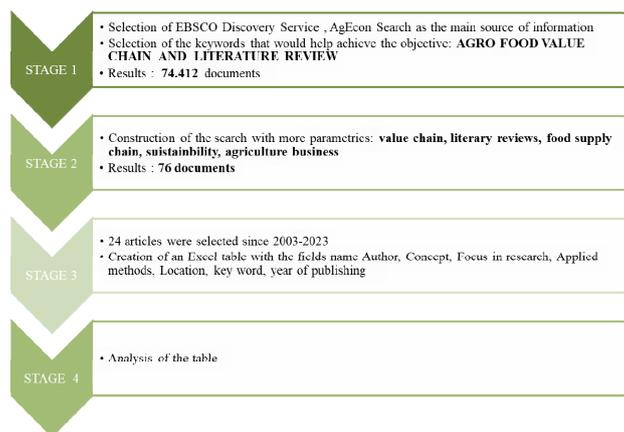
A sustainable food system (SFS) is a food system that delivers food security and nutrition for all in such a way that the economic, social, and environmental bases to generate food security and nutrition for future generations are not compromised (FAO, 2018). The concept of sustainable food value chains is defined as the complete range of farms and firms and their successive coordinated value-adding activities that produce specific raw agricultural materials and transform them into specific food products sold to end consumers and disposed of after use, in a manner that is profitable, has a wide range of societal benefits, and does not deplete natural resources permanently. According to Chouinard et al. (2011) the market is moving towards "demand-driven supply chains," so it is crucial to connect consumers not only with product design and retailing but also with the full impact of their choices. David (2014) highlighted that, unlike related concepts such as the supply chain, the concept of sustainable food value chains simultaneously emphasizes the importance of three elements. First, it recognizes that value chains are dynamic, market-driven systems in which vertical coordination (governance) is a central dimension. Second, the concept is applied broadly, typically covering an entire product subsector in the country (e.g., beef, corn, or salmon). Third, added value and sustainability are explicit, multidimensional performance indicators, assessed at the aggregated level. Food production faces multiple limiting factors for key resources such as land, water, energy, and inputs. We must use this challenge to stimulate creative innovations (Giovannucci et al. 2018)

The AFVC represents a complex network of activities and processes that enable the production, transformation, distribution, and marketing of food from agricultural producers to end consumers. Agro-value chains encompass activities that take place at various levels (farm, rural and urban), starting with input supply and continuing through product handling, processing, distribution, and recycling. As products move successively through the various stages, transactions take place between multiple chain actors, money and information are exchanged and value is progressively added (da Silva, de Souza, 2007).

### 3.4. Literature review

To conduct efficient research on the sustainability of agricultural value chains, a systematic approach was applied in selecting research methods and keywords for relevant literature search. Initially, general terms related to agricultural value chains were identified to encompass all relevant studies and documents. Subsequently, the term "sustainability" was included in the search to further focus the research on sustainability aspects in this context.

According to the presented search query in Picture 1, a total of 74,412 documents relevant to AFVC research were identified. Subsequently, using the additional search term "sustainability," 3,073 documents were identified to further refine the search. Additional terms such as "value chain," "literature reviews," "food supply chain" were included to narrow down the search. This led to a total of 167 documents. Further refinement with the addition of the term "agriculture" resulted in 76 works for this investigation. The systematic approach used for selecting methods and keywords facilitated the careful identification of relevant literature, enhancing the efficiency of analyzing information within the research domain of agricultural value chain sustainability.



**Picture 1: Stages of the Methodology**  
Source: Authors, 2024

To facilitate analysis, a carefully crafted Excel table was created, encompassing key fields such as author, concept and theme, keywords, research focus, approaches, applied methods, location, and key findings. This structured framework not only systematically organizes data but also facilitates comprehensive examination of the various approaches applied in the analysis of works, ranging from quantitative and qualitative approaches to mixed methods.

Through detailed examination, it was established that works published in the last 20 years (2003-2023) are much more suitable for understanding contemporary approaches to agro-food value chains, while earlier works are more suitable

for theoretical postulates and the development of value chains in the agricultural and food sector. To gain a better understanding of the analysis approaches used in measuring the sustainability of agri-food value chains, we divided our research into two segments. The first segment involves an analysis of the methods used in review papers, while the second segment covers studies directly addressing all the challenges relevant to the sustainability of agri-food value chains. These two segments allow us to delve deeper into methodologies and specific research focusing on various aspects of sustainability in agri-food supply chains.

**Table 1:** Analysis of methodologies in review papers on sustainability of AFVC

Autor	year	Quantitative	Qualitative	Mixed
Donovan, et all	2015			11
Minarelli, et all	2016	2	3	
Rejeb, et all	2022	3	1	6
Misra and Mention	2022	8	9	12
Barbosa, et all	2022			38
de Vriesia, et all	2022	33	27	15

**Source:** Authors based on EBSCO and AgEcon Search, 2024.

During the period from 2015 to 2023, in six papers were conducted a systematic review of total 168 papers in the field of sustainability of agri-food value chains, considering range of research methods. The first step of analysis was to devide applied research methods in three groups: quantitative, qualitative, and mixed. The results indicate a diverse range of research methods utilized by authors, with a predominant use of mixed methodology. Out of the total reviewed papers, mixed research methods were utilized in 82 papers, identified among 5 groups of authors: Donovan et al. (2015), Rejeb, et all, Misra and Mention (2022), Barbosa, et all, and de Vriesia et al. (2022). Quantitative methods were employed in 46 papers, identified among 4 groups of authors: Minarelli et all (2016), Rejeb et al. (2022), Misra and Mention (2022), de Vriesia et al. (2022), while qualitative methods were used in 40 papers, identified by same 4 groups of authors. It is noteworthy that most papers were analyzed using a mixed methodology, indicating a trend among authors to adopt multidimensional approaches to study the sustainability of agri-food value chains. Such an approach enables a deeper understanding of the dynamics and interrelationships within value chains in the agricultural and food industries.

As second step of the analysis, the geographic distribution of research methods used in systematic reviews on the sustainability of AFVC reveals a significant geographical variation in research approaches in this field. The largest number of papers covering the geographical region of Europe utilized combined research methods, followed by Asia and North America. This conclusion suggests higher research activity and interest in the topic of sustainability of agri-food value chains in Europe, Asia, and North America compared to Africa and Australia. Potential reasons for this could include a higher number of research institutions and resources in these regions, as well as specific characteristics of the agricultural and food sectors that are the subject of sustainability research.

**Table 2:** Analysis of methodological approaches in studies addressing sustainability in AFVC

Author	year	Variables	Methods	Quantitative	Qualitative	Mixed
Cucagna, Goldsmith	2018	Value Added Measure EVA, MEVA, CEVA, PEVA.	ordinary last squares regression model, probit model	X		
Kurgat et al.	2018	improved irrigation,integrated soil fertility, organic manure and crop diversification.	A multivariate probit (MVP)	X		
Walder et all	2019	various types of innovation.	Negative Binomial Model, Circle of Basic Human Values, Poisson model			X
De Silva, Jayamaha, Garnevaska	2023	Initiatives for farmer development implemented by the buyer and sustainable performance of farmers (TBL outcomes for farmers).	conceptual research			X
Vrabcová P. Urbancová, H.	2023	the sector of an organization, the size of the organization by the number of employees, majority ownership, the type of organization and the annual turnover.	multivariate factor analysis, individual interviews			X
Akyüz, et all	2023	value added, net present value, internal rate of return, cash flows and cost of fixed assets, or break-even point, private and social prices of goods and services, consumer behavior, consumption decision-making process.	value added analysis, financial analysis, policy analysis matrix (PAM), and end market analysis			X
Benitez-Altuna	2024	engagement, adopting sustainable agricultural practices depending on the type of contract and relationship characteristics with buyers.	analysis of variance, logit modeling	X		

Source: Authors based on EBSCO and AgEcon Search, 2024.

According to the data from Table 2, the results indicate a wider application of quantitative and mixed methods in research on the sustainability of agri-food value chains, while qualitative methods were not used in the sample. The quantitative approach enables systematic collection, processing, and analysis of data to extract relevant information and draw well-founded conclusions. In this context, the sustainability of agricultural systems was investigated through the application of quantitative analysis methods in the works of Kurgat et al. (2018), Cucagna and Goldsmith, (2018) and Benitez-Altuna (2024). Kurgat et al. (2018) focused on enhancing agricultural production through the integration of various agro-technical approaches, including improved irrigation, soil fertility integration, organic fertilization, and crop diversification. This study used the quantitative method of multivariate probit regression to analyze the sustainability of rural and peri-urban vegetable farms, with a sample of 658 farms. Similarly, Benitez-Altuna (2024) explored the sustainability of agricultural practices through the analysis of farmers' engagement in promoting sustainable development. Quantitative methods of variance analysis and logistic modeling were used to examine the issue of farmer engagement under different contracts and relationship characteristics with buyers, with a sample of 352 farms participating in the study. Cucagna and Goldsmith (2018) applied ordinary last squares regression and probit models to panel data of financial information from a sample of 454 observations, focusing on value creation in agribusiness organizations.

Research on the sustainability of agricultural and food supply chains has encompassed a wide range of analytical methods to gain a comprehensive understanding of sustainability. The combination of quantitative and qualitative methods has allowed for a detailed examination of complex phenomena. For instance, Walder et al (2019) explored different innovations using Negative Binomial, Circle of Basic Human Values, and Poisson models on data from 174 farmers, providing deep insights into innovative practices and their impact on agricultural sustainability. De Silva, et al. (2023) delved into the economic, social, and environmental aspects of sustainability through the conceptual research by using initiatives for farmer development implemented by the buyer and sustainable performance of farmers (TBL



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**Marija Jeremić**University of Novi Sad  
Faculty of Economics in Subotica  
Subotica, Serbia  
marija.jeremic@ef.uns.ac.rs**Bojan Matkovski**University of Novi Sad  
Faculty of Economics in Subotica  
Subotica, Serbia  
bojan.matkovski@ef.uns.ac.rs**Stanislav Zekić**University of Novi Sad  
Faculty of Economics in Subotica  
Subotica, Serbia  
stanislav.zekic@ef.uns.ac.rs

## THE GREEN FOOD SUPPLY CHAIN CONCEPT

**Abstract:** The traditional food supply chain is a complex network of interconnected entities whose function is to supply consumers with enough health-safe products, i.e. enough food with optimization of production and distribution. In the previous period, the traditional supply chain has faced numerous challenges and problems. Globalization, climate change, changes in living standards and consumer preferences, limited natural resources (agricultural land and water), growth in the amount of food and packaging waste, as well as food insecurity led to creation of numerous national and international regulations and agendas related to environmental protection. Those regulations and agendas influence various business philosophies, including the philosophy of food supply chain management. With its focus on optimizing production and distribution of food, the traditional supply chain cannot meet the international regulations' requirements. Because of that it was necessary to go in the direction of greening the activities of the traditional supply chain, i.e. in the direction of defining the concept of a green food supply chain. The concept of a green food supply chain represents an improved, wider concept of a traditional food supply chain that, apart from standard activities, agricultural production, processing and distribution of products, also includes additional activities such as green procurement, green product design and reverse logistics. Therefore, bearing in mind that in the future food should be produced and distributed in a way that pollutes the environment as little as possible, the aim of the research is an analysis of the importance of the green supply chain concept in food production and distribution. Considering the defined goal, the literature review method was used with a focus on the Scopus database. The results of the research indicated that due to the complexity and frequent changes of regulations in practice, the green supply chain concept is still not sufficiently applied.

**Keywords:** food, supply chain, green.

### 1. INTRODUCTION

The traditional food supply chain is a complex network of interconnected entities whose main function is to supply consumers with a sufficient amount of health-safe products, i.e. enough food, considering the optimization of food production and distribution. Ever since the second half of the 19th century, the food system has been exposed to the influence of globalization, which greatly contributed to the increase in the number of participants in the food supply chain who mediate between producers and consumers, thereby creating long, or global, food supply chains (Soria-Lopez et al., 2022). Apart from the numerous advantages that globalization has had on the food system, globalization has also brought a certain number of negative aspects. More precisely, the globalization of industrialization and trade activities has caused an increase in complications in the food supply chain (Qin et al., 2022), and one of the most significant is certainly the degradation of the environment (Soria-Lopez et al., 2022), due to the negative effects that the activities of each of the participants have on the environment (Petljak, 2019; Matani et al., 2015). The number of participants in the food supply chain is increasing, and the path that food travels from the place of production to the place of consumption is getting longer, which requires the use of enormous amounts of resources such as energy, water, land and others. Along the way, numerous environmental problems arise, such as adverse impacts on biodiversity, climate change and greenhouse gas emissions, soil and water pollution. As a result of such trends in the market, many so-called green regulations have been created, which impact all business concepts and the supply chain concept. In addition to the growing number of national, regional and international regulations related to environmental protection, changing consumer demands (Despoudi, 2020),

pressures from various interest groups (Miljušković, 2015), limited natural resources, food insecurity, population growth, climate change and increased amounts of food loss and waste generated along the food supply chain necessitates the need to redefine the concept of the traditional food supply chain (Despoudi, 2020).

When it comes to international regulations, the Kyoto Protocol signed in 1997 by the United Nations is the first international binding agreement in the fight against climate change. The basic requirement of this protocol, adopted by 38 countries, is to reduce or limit the emission of greenhouse gases by industrialized countries to stop climate change. The Kyoto Protocol did not show significant results, and 20 years later, i.e. in 2016, the Paris Agreement was signed, which aimed to reduce global warming (Zekić et al., 2023). Likewise, the United Nations has defined 17 sustainable development goals that refer to future social and economic development in accordance with the principles of sustainability. The realization of these goals is very important from the aspect of environmental protection. Among those goals, a certain number of goals, such as goals related to the problem of hunger in the world, protection of natural resources, climate change and responsible production and consumption (source) are very closely related to the agricultural sector. On the other hand, the European Union represents an entity that certainly has the most developed regulations related to environmental protection. In the case of the agricultural sector, the first significant milestones related to the integration of ecological goals and the promotion of sustainable agriculture were related to Agenda 2000 as well as to the reform of ZAP from 2013, which are related to the previously mentioned international regulations (Đokić et al., 2022). In the last reform of ZAP EU, the European Green Deal and the strategy "From farm to fork" which aims to ensure the sustainability of production within all segments of the food supply chain were of great importance.

Changing consumer demands, in terms of increasing demand for healthy products (Despoudi, 2020), as well as increasing pressures from various interest groups (Miljušković, 2015; Petljak, 2019) have also largely contributed to the need to redefine the concept of the traditional supply chain and integrate an ecological way of thinking in the activities of all chain participants. In addition to the previously mentioned, the traditional supply chain has faced challenges such as the limitation of the most important natural resources, climate change and population growth. According to the United Nations (2021), food production occupies 50% of the land area suitable for living, accounts for about 70% of freshwater consumption and contributes to the production of a quarter of global greenhouse gas emissions. In addition, food production is considered the biggest generator of biodiversity loss, air and water pollution, deforestation and soil degradation. Land and water are the most important natural resources of great importance for the agricultural sector, and their limitation indicates the need for conservation and rational use. According to the OECD (2024), agricultural production represents the largest consumer and major polluter of water, which is why improving the management of water use in the agricultural sector is essential for a sustainable food sector. On the other hand, according to Đokić et al. (2022) land is a non-renewable resource whose limits are finite, and which, in addition to the production of food, fiber, fodder and biofuel, also affects climate regulation, soil functionality, and cultural landscape and recreation. In the case of the agricultural sector, the negative impact on the soil is generated to the greatest extent through intensive agricultural production, which in the long term can have a very negative impact on food security. By 2050, the number of inhabitants is expected to increase to around 9 billion. The expected increase in population will put additional pressure on limited resources and the environment through increased food demand and supply. Apart from the increase in population, the increase in per capita income significantly changes the structure of consumption in terms of increasing demand for products of animal origin, and the production of these products requires a greater burden on the environment in terms of greenhouse gas emissions, water use, land use, energy and application of nitrogen and phosphorus. To ensure a healthy and safe future for both the population and the planet, the growing population must be fed in a way that is healthy, equitable and sustainable (United Nations, 2021). Also, one of the more important issues related to the food supply chain that has a major negative impact on the environment is the large amounts of food waste generated along the supply chain. Food loss and waste are characteristic of all participants in the food supply chain. In the world, on average, about 30% of the total amount of food produced is thrown away annually (FAO, 2011), and in addition to further exacerbating the problem of world hunger, food waste generated in the supply chain puts pressure on water, land resources and climate, and according to the United Nations (2021) accounts for 8 to 10% of greenhouse gas emissions. Therefore, bearing in mind that in the future food should be produced and distributed in a way that pollutes the environment as little as possible, it is necessary to redesign the traditional chain and harmonize it with market requirements.

In accordance with the previously said, the aim of the paper is to analyze the importance of the green supply chain concept in food production and distribution. After the introductory discussion and definition of the research methodology, the next segment of the research considers the problem of defining the concept of traditional and green food supply chain, as well as defining the key differences between these two concepts. In addition, this part of the paper also includes the problem of defining the term green supply chain with an overview of synonyms used in the literature to define the same concept, as well as the difficulties that complicate the application of this concept among individual participants.

## 2. RESEARCH METHODOLOGY

An extensive literature review on the green supply chain and the selection of references is mostly based on the Scopus database and the following keywords were used during the search: green, food and supply chain. Only papers in English were considered, i.e. articles, reviews and conference papers from the fields of Business, Management and Accounting, as well as from the fields of Agricultural and Biological Science and Economics, Econometrics and Finance. In addition, individual research listed in the bibliography of papers taken from the Scopus database were analyzed.

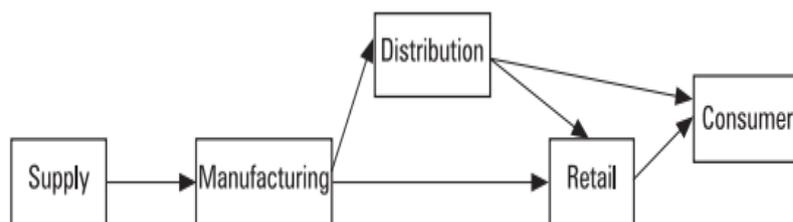
It is necessary to keep in mind the limitations of this research. Namely, it is very difficult to make a clear differentiation of the scope of the terms of traditional and green food supply chains based on a review of the previous literature, given that the definition of the term itself is quite diverse in the literature. Additionally, for the purposes of the review paper, it is quite difficult to find comparative analyzes between traditional and green food supply chains, and the literature is scarce when it comes to empirical data on the representation of certain chains in certain regions of the world.

## 3. TRADITIONAL VS GREEN FOOD SUPPLY CHAIN

### 3.1. Traditional food supply chain

The idea of supply chain management appeared in the early 80s of the 20th centuries, after which it was soon widely spread and accepted in various segments, including in agribusiness. The food supply chain represents the phenomenon of the movement of agricultural products from the agricultural sector to the final consumers (Jeremić, 2018). It is a network of organizations that, through mutual economic relations, ensure the production and distribution of food (Yakovleva, 2007). Bukeviciute et al. (2009) argue that the food supply chain consists of a wide range of products and companies that operate in different markets and sell a variety of products, and that the key sectors of the supply chain are the agricultural sector, the food industry and the distribution sector. According to El Ayoubi and Radmehr (2023) the food supply chain consists of related entities engaged in the production and sale of food produced from raw materials of agricultural origin. The authors also believe that effective supply chain management should increase sales while reducing costs along the entire supply chain. According to Beamon (1999), a traditional supply chain represents an integrated production process where raw materials are processed into final products and then delivered to customers through the distribution sector (Picture 1). The author believes the traditional supply chain focuses on optimizing the procurement of raw materials from suppliers and distribution from the manufacturer to the customer. According to Veljković, Milovanović and Talić (2022) the traditional supply chain focuses mostly on:

- Determining the most efficient production and distribution of products;
- Optimization of raw material stocks and the number of participants in the chain;
- Management of customer-supplier relationships.



**Picture 1:**Traditional supply chain

Source: Beamon, 1999, pp, 336

However, the increasing importance and problems related to environmental pollution caused by the activities of traditional supply chain participants have imposed the need to integrate an environmental component into the activities of chain participants as well as the need to redefine the concept of the traditional food supply chain.

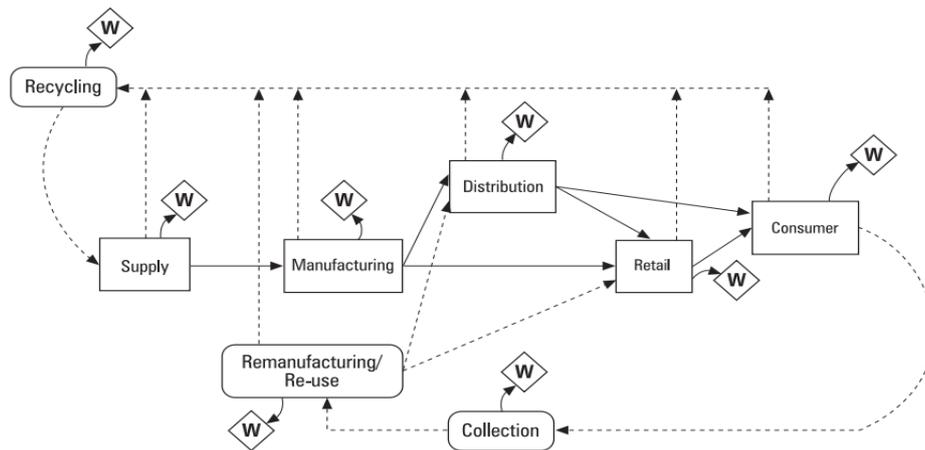
### 3.2. Green food supply chain

The green food supply chain implies the inclusion of an ecological way of thinking in the concept of a traditional food supply chain due to the impact that the activities of the participants have on the environment. The green supply chain concept represents an expanded version of the traditional supply chain that is gaining more and more importance among

both supply chain participants and researchers. The very name in the term indicates the fact that in the past period the focus in relation to environmental protection has shifted from individual participants to the entire supply chain. Apart from the broader scope of activities that the participants of the chain perform, the concept of a green supply chain differs from the concept of a traditional chain in certain segments. According to Matani et al. (2015) segments in which the concept of a traditional supply chain differs from the concept of a green supply chain include the following:

- While the traditional supply chain focuses on minimizing costs and improving the efficiency of the entire chain to maximize economic benefit, the green supply chain also seeks to maximize economic output while reducing energy and resource consumption to reduce pollutant emissions all to achieve a balance between economic and social benefits and environmental impact.
- In addition, in the case of these two concepts, the business model and business process are also different. That is, the business model of the green supply chain is more complete because it also includes an ecological component, unlike the traditional concept where that component was completely absent. In the case of a business process, in a traditional supply chain, the flow of activities moves in one direction from the procurement of inputs and raw materials to end consumers, while in the case of a green supply chain, activities move in both directions.

The concept of a green supply chain has been a subject of interest since the beginning of the 21st century, when it was first defined (Miljušković, 2015). However, when it comes to defining the term green food supply chain, there is still an inconsistency of definitions and a lack of uniformity in terminology (Petljak, 2019), which makes it somewhat difficult to compare different research related to this issue. Regardless of the absence of a single definition of the term green supply chain, the interest in researching this issue is increasing, and the environmental responsibility of the participants is becoming imperative in the business philosophies of many companies, especially in the case of companies engaged in production, as is the case with companies that produce and process raw materials of agricultural origin. In the literature, there are currently many synonyms used in parallel with the term green supply chain, and some of the most used synonyms are sustainable SCM (Ali et al., 2016; Seuring and Müller, 2008; Linton, Klassen and Jayaraman, 2007;) and environmental SCM (Jabbour et al., 2014). Apart from the disagreement on terminology, according to Perotti et al. (2012) among the authors who deal with this problem, there is a dilemma regarding the motivation of the participants for the application of this concept, as well as regarding the level of the chain at which the analysis needs to be performed. More precisely, the dilemma regarding the motivation of the participants implies the disagreement of individual authors regarding whether the application of this concept is a matter of coercion or the good will of the participants, while the disagreement regarding the level of analysis refers to the author's opinion as to whether the analysis is better to be performed at the level of individual participants, or there is still a need for analysis at the level of the entire supply chain. In her paper, Petljak (2019) states that most of the research that has been conducted focuses on only one segment of the green supply chain, and that there is still a lack of an integrative approach to green supply chain management research, which many researchers consider very important. Although many authors equate the term green supply chain with the previously mentioned synonyms, in his research Miljušković (2015) analyzes the transformation process of the food supply chain from a traditional to a green supply chain and clearly delineates the difference between the terms sustainable supply chain, closed-loop supply chain and green chain as the most comprehensive supply chain concept to date. Also, the author states that the concept of the traditional chain was followed by the development of the concept of a sustainable supply chain, which brought significant innovations and improvements in terms of the traditional chain. However, at the end of the 90s of the 20th centuries, because of increased legal regulation in Europe, the concept of a closed-loop supply chain was created, which, unlike the traditional and sustainable chain, also included return activities whose basic task is to return value while fulfilling environmental standards. In his paper, the author states that the previous concepts mostly lacked strategic breadth and that they therefore served as a basis for discrediting the most comprehensive concept, that is, the green supply chain concept. One of the most frequently cited definitions of the green supply chain is the definition of the author Srivastava (2007), who under the green supply chain means integrating an ecological way of thinking into the concept of supply chain management, including product design, procurement and selection of materials, production and distribution of products to end consumers, as well as product management after the expiration of his life span. Beamon (1999) believes that the concept of a green supply chain is an extended version of the concept of a traditional chain because, in addition to the basic activities of a traditional chain, it also contains additional activities (Picture 2). More precisely, in Figure 2, the solid lines represent the traditional supply chain, while the dotted lines show additional activities specific to the green supply chain concept. The W label means waste generated at all levels of the supply chain and that participants should take care of.



**Picture 2: Extended supply chain**  
**Source: Beamon, 1999, pp, 338**

According to Lau (2011), the concept of a green supply chain is defined as the integration of environmentally conscious thinking into the supply chain, including product design, material procurement, production, distribution of the final product to consumers and end-of-life management of products. Likewise, according to Srivastava (2007) the green supply chain includes ecological production and ecological transport of products, as well as return logistics. The authors Davies and Hochman (2007) believe that the management of the green supply chain requires a holistic approach, that is, it requires the improvement of environmental results at all levels of the supply chain. Likewise, the authors Wang and Gupta (2011) also believe that for the supply chain to become completely green, the integration of green activities within all participants is necessary. In addition, the authors believe that some of the benefits that would be realized by applying this concept include reducing the use of energy, reduced consumption of natural resources as well as reduced problems related to pollution (Jaggernath, 2013). On the other hand, the author Jaggernath (2015) believes that adopting the green supply chain concept achieves the following environmental benefits:

- Improvement in energy use.
- Waste reduction.
- Reduction of greenhouse gas emissions.
- Water conservation.
- Increase in energy efficiency.
- Reducing the release of toxic chemicals into waterways.

Regardless of the fact that in the XXI century there has been a significant turn in the business philosophy of supply chain management in the direction of the green chain concept and regardless of the previously mentioned benefits of that concept, green business practices are still, due to a number of factors, not incorporated and applied by of all countries and business entities around the world. For example, apart from the lack of government initiatives related to the implementation of this concept, some are not familiar with the way of adopting and applying this concept, while some are slower to adopt this concept due to the misconceptions that are present in relation to the concept of green supply chain (Jaggernath 2015). Even today, the concept of green business is rather ambiguous, vague and broad, which proves the variety of definitions based in the literature. Poor understanding leads to confusion but also to disagreements and disputes between supply chain participants who should be working towards achieving a common goal. In addition, the implementation of the green supply chain concept is delayed due to the complexity and frequent changes in green regulations. In order to operate more successfully in the future, the participants of the food supply chain will have to understand how in the future climate changes will affect the functioning of the chain, and to align their business strategies with those changes, because by greening the activities of the participants of the supply chain, not only environmental protection is achieved but also reducing the costs of the participants as well as increasing the flexibility of the supply chain. Greening the supply chain requires strategic business transformation and collaboration along the entire supply chain that can only happen if participants integrate green initiatives into their core strategies (Despoudi, 2020). All participants in the supply chain should work together to ensure a positive impact on the environment.

## 4. CONCLUSION

Due to the observation of the negative effects of the activities of individual supply chain participants on the environment in the XXI century, there has been a significant change in the business philosophy of supply chain management. The concept of the traditional chain has so far undergone significant modifications in terms of greening the activities of the

supply chain participants. Participants in the food supply chain are also some of the biggest polluters of the environment. More precisely, the production of food products creates numerous environmental risks through the excessive use of limited resources, the emission of gases with the greenhouse effect, and through the generation of large amounts of waste. Today, when competition no longer exists between individual chain participants but between food supply chains, and when environmental protection requirements have become imperative, the integration of an ecological way of thinking into the activities of food supply chain participants is more important than ever. Greening the activities of participants in the food supply chain will be one of the most important goals in the future for those participants who will strive to protect the living environment by reducing pollution. That is, the rational use of limited resources and energy, the reduction of the amount of packaging and food waste generated along the food supply chain will represent one of the most important segments of food supply chain management in the future. In order to successfully realize the idea of greening the activities of chain participants in the coming period, it is imperative that all chain participants integrate ecological thinking into their activities.

Bearing in mind the fact that one of the most important factors contributing to the inadequate application of this concept among chain participants is the lack of understanding of the concept and the absence of a single definition, future research should be directed towards finding a single, homogeneous definition and methodology that will deal with analyzing this problem both at the level individual participants, as well as at the level of the food supply chain.

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**Dejan Brcanov**Faculty of Economics in Subotica, University of  
Novi Sad  
Subotica, Serbia  
e-mail: dejan.brcanov@ef.uns.ac.rs**Nebojša Gvozdenović**Faculty of Economics in Subotica, University of  
Novi Sad  
Subotica, Serbia  
e-mail: nebojsa.gvozdenovic@ef.uns.ac.rs

## **STRATEGIC DECISIONS IN LOGISTIC OF SUGAR BEET CAMPAIGN**

**Abstract:** Managers of sugar beet processing companies need to decide which parcels will become part of the campaign, as well as the time when the beets will be collected from it. Such decisions have far-reaching consequences in a logistic chain. The company strives to optimize transportation costs, but at the same time, that the goods are collected at optimal quality, and processed timely. Simultaneously, an effective transport plan implies the use of minimal amounts of fuel, as well as being environment friendly. We will present a mathematical model to support the decision-making process.

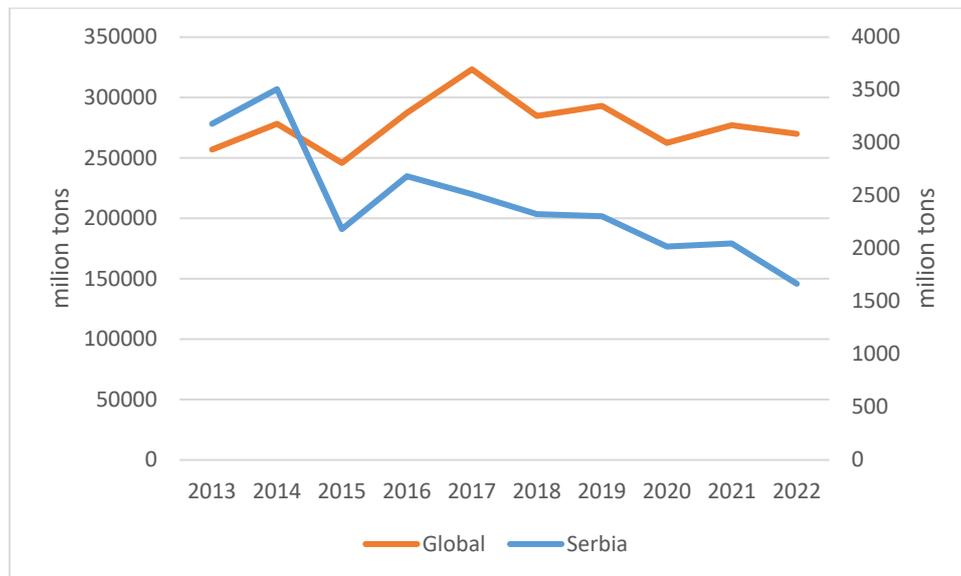
**Keywords:** Sugar beet, logistics, supply chain, planning, transportation

### **1. INTRODUCTION**

The agro food supply chain is imbued with a large number of activities, including seeding, irrigation, harvesting, processing and distribution to final consumers. Each of these processes are accomplished and especially linked with some form of transport activities. Therefore, adequate planning and synchronization is necessary to achieve a desired value chain. The sugar industry is by no means an exception. Moreover, the raw materials sugar beet and cane are often grown on a large and sparse parcels. In order to increase the profit, companies seeks for a tool capable to optimize processes and transportation plans.

According to FAO database, in 2022 the worldwide production of sugar beet and sugar cane was approximately 2296 million tons. By analyzing a period between 2013. and 2022, we found that shares of sugar beet and sugar cane are 12% versus 88%, and that these figures are without significant variations. Largest producer of sugar beet is Russia, holding a share of 13-18% total sugar beet production, while largest producer of sugar cane is Brazil with a share of 36-39% of total sugar cane production. This puts a Brazil as largest sugar producer. Analyzing agricultural yield data from sugar beet plants, we found that the best is Chile with 102 tones/ha, while Russia with 42 tones/ha ranks as a 36. In the paper Kolfshoten et al. (2014). authors mark that “sugar beet is currently the cheapest sugar source and lowest in water usage, as well as being an effective biomass source”.

In Serbia there are no sugar cane plants, complete production of sugar is based on sugar beet. On picture 1 is shown sugar beet production in period 2013-2022 compared with a global production. We can see a small depreciation of production in Serbia over a given period. With average production of 2,4 million tons, Serbia shares less than 1% of worldwide sugar beet production. With a 47807ha, Serbia ranks as a 19th country with a soil seeded with sugar beet. Average agricultural yield over a 10-year period is 51 tones/ha.



**Picture 1:** Sugar beet production in period 2013-2022.

In this research we deal with a mixture of strategic and tactical decisions regarding the sugar industry supply chain. The rest of the paper is organized as follows. Section 2 is devoted to a literature review, in Section 3 we present a problem description and results in section 4.

## 2. LITERATURE REVIEW

In the work of Higgins (2006), author emphasize the influence of decreased sugar prices on international level to the role of optimizing the agro logistic chain, especially the synchronization of harvesting and transporting activities.

In López-Milán, Plà-Aragonés (2014), authors stress the complexity and multicriteria of the optimization problem. Namely we confront two very often opposed goals: minimization of transportation costs and maximization of resources quality. To make a decision process traceable and optimization doable, most often research is directed to cost minimization. Regardless of the complexity of the problem itself, harvesting campaign is often accompanied with a poor transportation possibilities namely the heterogeneity of the fleet. Therefore, synchronization becomes even more important. That characteristic can be seen in many logistics problems, from newspaper delivery problem Bala et al. (2010), multi-echelon distribution Bala et al. (2017), but also in scheduling of the vehicles in a harvest season, Gvozdenović, Brcanov (2018).

As indicated in many papers, for example see Behzadi et al. (2018), many activities in agro supply chain have to deal with supply spikes. Also, the nature and long lead time of supply material can have a large impact on planning activities. In the research of Rong, et al. (2011), or van der Vorst, et al. (2009), authors signify degradation of resources over time stressing the endowment of logistics activities.

In Grunow et.al. (2007), authors hierarchically structure the problem into three levels: cultivation, harvesting and dispatching. Authors represent MILP model for the first two phases and use a commercial software to solve transportation level. The solution is applied to case study of sugar cane in Venecuela.

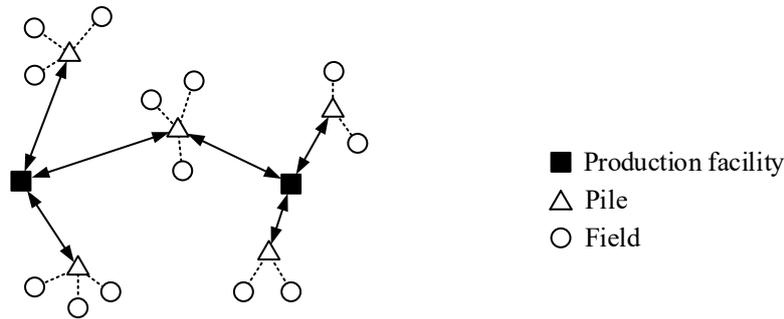
In Higgins (1999) author deals with strategic to tactical harvest planning and provide a non-linear MIP model. The main direction of the research was on harvest date and crop cycle length. The application of the model on sugar cane producers in Australia led to 7% net revenue increase.

The work of Higgins (2006) represents a model that schedule vehicles from farms to loading pads. Case study where findings are adopted comes from Australia. Authors apply the metaheuristic approach – tabu search and variable neighborhood search. As it is already known, metaheuristic algorithms are often applied when a decision maker does not set optimality as a prime goal of optimization. Common phrase that metaheuristic finds reasonably good solution for a reasonably amount of time plays its role in this case. Managers point that each solution needs some fine tuning before being adopted, since many practical constraints have to be accounted in solution. Also, real time scheduling was set as priority thus applying any solution that reduce the costs was satisfactory.

In Gvozdenović, Brcanov (2018) authors represent a model and a heuristic algorithm including a large fleet of vehicles, loading machines, where a high degree of synchronization has to be adopted to maintain the efficient employment of all participants. The main idea was the minimization of waiting times, which leads to higher degree of utilization. A solution is modeled on a time-space network which was explored via metaheuristic simulated annealing. A fast and competitive solutions were constantly improved and updated with new information.

### 3. PROBLEM DESCRIPTION

The planning of sugar beet harvesting has to be done in such a manner that enables reaching the optimal profit. However, profit is influenced with many factors, such as fuel costs, crew and vehicle fleet, available machinery for extraction of beet and loading on transportation vehicles, but also on maturity and quality of beet, and finally the necessity of continuous activity in production facility. As a biggest problem in this chain, managers point the lack of raw materials in production facility. Therefore, continuous processing can be seen as the highest goal or as a constraint in an optimization process. In this paper we will omit the decisions regarding the time when the beets are harvested. We rather focus on the transportation process of collecting the sugar beet to the factory. The sugar beet are combined from several fields, and scattered piles are located close to the solid paths. There the loading machines throw the beet to the transporting vehicle and the quantities of beet are transported to the manufacturing objects. Since there are few manufacturing objects, one of the arising questions is to which production facility goes a particular truck of the raw material. On Picture 2 are shown two production facilities, and 5 piles of sugar beet. All the beet from the fields is transported tracing the dotted lines to the piles. Transportation that is analyzed in this work is the represented with solid lines, operating between piles and production facilities. Although the assignments of two leftmost and two rightmost piles seems to be obvious, the position of central pile can rise a question to which mill the beets should be assigned, the left or the right production facility.



Picture 2: Typical transportation scheme.

Since location of production mills are given, and their positions cannot be altered without excessive investments, the locations of fields and piles have a great impact on total transportation costs. Further, the quality of the roads can deviate a plain geographic view, since moving of the vehicles on a normal roads, rather than on a country roads between the fields, can be more time and fuel costly. To include the weather conditions, total capacities of vehicles can be fully utilized if the truck moves on the asphalt roads instead of dirt roads. All of these peculiarities are taken into account when a manager calls a certain route to be conducted.

### 4. MODEL AND RESULTS

Let  $P$  be a set of indices denoting the set of piles. For each  $p \in P$  let  $q_p$  denote the quantity of accumulated sugar beet at pile  $p$ . With  $F$  we denote the set of production facilities. Let  $d_{fp}$  denote the distance between each  $f \in F$  and  $p \in P$ . We can assume that distance matrix is symmetric, that is  $d_{fp} = d_{pf}$ . The cost of transport between two locations is given and denoted as  $c_{fp}$ . Further, suppose that capacity of each production facility, including the space for accumulating resources, is  $C_f$ . Let us introduce the binary decision variables  $t_{fp}$  that equals 1 if beet is transported from pile  $p$  to production facility  $f$ , and 0 otherwise.

Regarding the introduced notation, the goal of each campaign, to achieve an optimal transportation costs can we written as:

$$\min \sum_f \sum_p d_{fp} c_{fp} q_p t_{fp}.$$

Following the capacity of production facility, that can handle the maximum quantity of the beet at any time, we write the constraint:

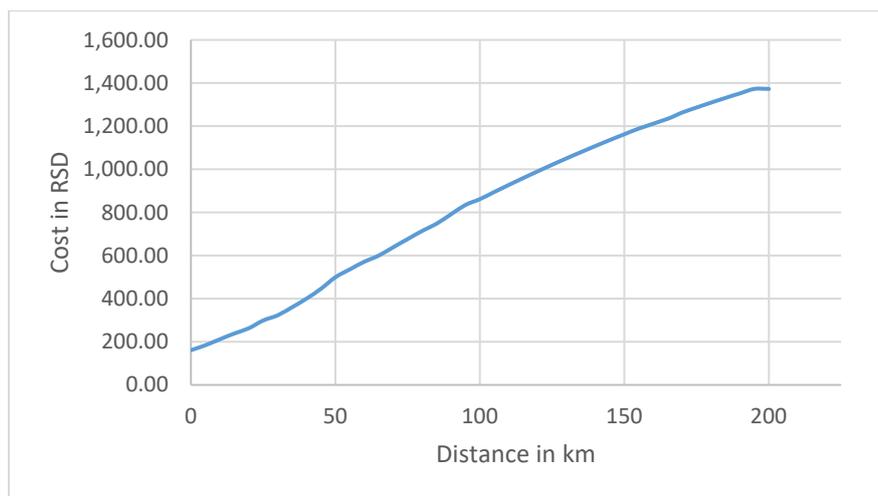
$$\sum_p q_p t_{fp} \leq C_f, \text{ for each } f \in F.$$

With respect to all contracts between producers of sugar beet and production company, we expect that all extracted sugar beet resources are transported to some production facility, that is:

$$\sum_f t_{fp} = 1.$$

In the case study considered within this research, there are three production facilities, with total capacity 85646720, 55341560, 112313460 tons respectively. The number of piles is 222 accumulating total 253301740 tons of sugar beet.

Cost of transportation is given in tones per km. Relationship between transportation costs and distance is depicted in Picture 3, from where we can see that there exists almost linear form.



**Picture 3:** Relationship between transportation costs in RSD and distance in km.

To obtain an optimal solution, we use LP solve version 5.5.2.11. By comparing the optimal solution and realization plan, we have found that transportation costs are higher by 11%. Result comes from different pile-facility allocation, which was found in 55 pairs, that is in 25%.

To make an insight on influence of production facility capacity constraint, we made additional tests with higher capacities. More precisely:

- If the capacity of production facilities is increased by 10%, the transportation costs can be reduced by 6%, summing to total reduction of 17%.
- If the capacity of production facilities is increased by 20% in total, the transportation costs can be additionally reduced by 4%, summing to total reduction of 21%.

## 5. CONCLUSIONS

By analyzing the transportation costs generated in the harvesting season with an optimal plan, we came to conclusion that there is a significant gap and space for improvement. In allocation piles to production facilities there was 25% of mismatch enabling 11% of savings in transportation costs. Benefits on environment are not taken into account, but we believe that there is a significant correlation between the two. However, transportation distance is not the only aspect that managers account in decision making process. Safety stocks, maturity and quality of sugar beets also play important role in the allocation process. Also, weather conditions can have a strong impact on dynamics of collecting the beets, but also on the transportation phase. The significant share of transportation activities is taken on a dirt roads, and as such, decision makers have to achieve their functionality.

In future work we will address a more comprehensive approach that will require more sophisticated data. As noted by many authors, the key in savings can be found in more collaborating actors, thus leaving more space to reduce total costs of the entire value chain.

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### **Danilo Đokić**

University of Novi Sad, Faculty of Economics  
 in Subotica  
 Subotica, Serbia  
 e-mail: danilo.djokic@ef.uns.ac.rs

### **Bojan Matkovski**

University of Novi Sad, Faculty of Economics  
 in Subotica  
 Subotica, Serbia  
 e-mail: bojan.matkovski@ef.uns.ac.rs

### **Žana Jurjević**

University of Novi Sad, Faculty of Economics  
 in Subotica  
 Subotica, Serbia  
 e-mail: zana.jurjevic@ef.uns.ac.rs

## **THE INFLUENCE OF USING MINERAL FERTILIZERS ON THE OUTPUT IN CROP PRODUCTION: CASE OF THE SOUTH BAČKA DISTRICT**

**Abstract:** In scientific research in the field of agricultural economics, in the last decade, the ecological effect of the use of chemical inputs has been increasingly in focus. Changes within the EU's Common Agricultural Policy, stimulated by the European Green Deal, contributed significantly to this trend. Following the above, the goal of this research is to determine the effect of mineral fertilizers on the output in different lines of crop production in South Bačka District. The FADN database was used in the work. The results showed that using mineral fertilizers is a significant factor in crop production. Also, a positive correlation between the use of mineral fertilizers and yield was identified in the production of corn and soybeans. In contrast, a negative correlation was present in the case of wheat and sunflower production. The negative correlation suggests that the mineral fertilizer was used suboptimally and that weather conditions significantly affected this production and prevented the absorption of nutrients. In addition, there are nitrogen surpluses, which threaten the environment. The estimated losses are 26 tons of nitrogen.

**Keywords:** Crop production, Fertilizers, FADN

### **1. INTRODUCTION**

One of the key topics of contemporary European policies is the use of chemical inputs, especially the use of nitrogen fertilizers. One of the critical goals of the Farm to Fork strategy is to reduce nutrient losses by at least 50% while ensuring that there is no deterioration in soil fertility (European Commission, 2024). Also, this Strategy emphasizes the problem of the excess of nutrients (primarily nitrogen and phosphorus) in the environment, stemming from excess use and the fact that not all nutrients used in agriculture are effectively absorbed by plants, which is another primary source of air, soil and water pollution and climate impacts. In addition, this Strategy was also the basic document for the creation of the new Common Agricultural Policy 2023-2027.

In the Republic of Serbia's Strategy of Agriculture and Rural Development for the period 2014-2024, one of the priorities is achieving sustainable economic, ecological, and social development goals, in which multifunctional agriculture and rural development have a unique role (MAFWM, 2014). Although an environmental goal was prioritized, special attention was not directed to chemical inputs. As this Strategy expires in 2024, the use of chemical inputs may be the focus of the new Strategy.

The fundamental question is, how does using mineral fertilizers impact output? Two primary objectives of the research arise from this question. The first goal is to determine the effects of fertilizer use on output based on the approximation of the production function. Another goal is to find out how strong the correlation between nutrient use (nitrogen, phosphorus, and potassium) and yields in different crop productions (corn, wheat, soybean, and sunflower) is. Additionally, nitrogen losses are observed in the productions mentioned above.

Approximation of agricultural production function was a subject in a few scientific papers in previous periods. Based on data for the period 2008-2019, Đokić et al. (2024) results showed that the increase in the use of mineral fertilizers is a key source of production growth among production factors. Similar conclusions concerning the function of partial productivity were drawn from Đokić et al. (2022). The research results showed that using mineral fertilizers is a crucial source of growth in land productivity in these countries. The importance of mineral fertilizers for production growth is undeniable, and nitrogen is considered an essential nutrient. Nitrogen is responsible for feeding approximately 48% of the global population, but a large portion of the N applied to the agricultural land is lost to the environment (De Notaris et al. 2018).

This research is structured as follows: After the introduction, the research methodology and database are explained. Then, the results of the research and discussion follow. Finally, basic conclusions and guidelines for potential future research are given.

## 2. MATERIALS AND METHODS

This research used the FADN (Farm Accountancy Data Network) database. In last few years, this database is widely used in Serbia (e.g. Popović et al. 2020; Novaković et al. 2020; Milić et al. 2023). Only agricultural farms from the South Bačka district were analyzed, assuming they produce in similar agri-environmental and climate conditions. The sample includes 51 farms that produce arable crops, the most common of which are maize, wheat, soybeans, and sunflower. The data refers to the year 2022. The research methodology includes three segments. The first segment implies the approximation of the Cobb-Douglas production function based on the following variables:

- Total output (Y) - Total value of output of crops and crop products in RSD.
- Total labour input ( $X_1$ ) - Total labour input of holding expressed in annual work units (full-time person equivalents).
- Total utilized agricultural area ( $X_2$ ) - Total utilized agricultural area of farm. Does not include areas used for mushrooms, land rented for less than one year on an occasional basis, woodland and other farm areas (roads, ponds, non-farmed areas, etc.). It consists of land in owner occupation, rented land, land in sharecropping. It is expressed in hectares.
- Capital ( $X_3$ ) - Capital is calculated as fixed assets less the value of land in accordance with Czubak et al. (2021).
- Fertilizers ( $X_4$ ) - Purchased fertilizers and soil improvers (excluding those used for forests).

The created model has the following form:

$$\ln Y = \alpha + \beta_1 \ln X_1 + \beta_2 \ln X_2 + \beta_3 \ln X_3 + \beta_4 \ln X_4 + \gamma$$

Unlike the production function model for the entire agricultural production (Swinnen & Vranken, 2010), the critical difference with this model is that it does not include livestock, as it only refers to crop production. Unlike older models that are based on the FAOSTAT database, the FADN database enables the incorporation of intermediate consumption in the model. However, as this paper aims to analyze the effect of mineral fertilizer, this variable is taken as an approximation of intermediate consumption.

The second segment involves creating a correlation matrix between nitrogen fertilizer consumption and actual yields in the production of corn, wheat, soybeans, and sunflowers to determine which production line this interdependence is most significant. The last research stage is a calculation of nitrogen losses by production lines within the given sample.

## 3. RESULTS AND DISCUSSION

In the model (Picture 1), the normality of the distribution of residuals was tested by the Shapiro-Wilk W test for normal data, and autocorrelation, multicollinearity and heteroskedasticity were also tested. Autocorrelation does not exist based on the distribution of residuals, while the VIF test (Mean VIF = 3.4) proved that there is no harmful multicollinearity. Heteroskedasticity was examined based on the Breusch-Pagan/Cook-Weisberg test for heteroskedasticity and the null hypothesis of homoskedasticity was accepted ( $p=0.2378$ ). Using the Ramsey RESET test, the null hypothesis that the model has no omitted variables was tested, which is accepted ( $p=0.2607$ ), and it is confirmed that the specification of the model is correct. Descriptive statistics is given in Appendix.

Source	SS	df	MS	Number of obs = 51		
Model	37.7722539	4	9.44306347	F( 4, 46) =	131.22	
Residual	3.31042549	46	.071965772	Prob > F =	0.0000	
Total	41.0826794	50	.821653587	R-squared =	0.9194	
				Adj R-squared =	0.9124	
				Root MSE =	.26826	

Y	Coef.	Std. Err.	t	P> t	[95% Conf. Interval]	
Labour	.0456134	.0878178	0.52	0.606	-.1311547	.2223815
Land	.6359721	.1098827	5.79	0.000	.4147898	.8571544
Capital	.0195766	.0430605	0.45	0.652	-.0670997	.106253
Fertilisers	.3730315	.0838569	4.45	0.000	.2042362	.5418267
_cons	7.898242	1.115567	7.08	0.000	5.652722	10.14376

**Picture 1:** Estimation of the regression model using Ordinary least square (OLS)

**Source:** Author's calculation based on FADN, 2024.

The model explained 91.94% of the variations of the dependent variable, which is indicated by the high coefficient of determination. What is most significant in the estimated model, from the point of view of the subject of this research, is the statistically significant positive influence of the independent variable mineral fertilizer on the dependent variable, i.e. output. The results of the analysis show that with one added unit of mineral fertilizer costs, the output increases by 0.37 with other unchanged units. This coefficient is higher than in the case of the research conducted by Đokić et al. (2024), which refers to the entire agriculture in the transitional countries of Europe and amounts to 0.10. Such a result is expected considering that livestock production is included in that model, so the influence of mineral fertilizer on output is weaker.

Table 1 shows correlation between mineral fertilizers use and yields in crop production. In the observed sample, corn was produced on 879 hectares, with an average yield of 5.93 t/ha. This yield is above the average for the entire country, 4.9 t/ha, and the Vojvodina region, 5.4 t/ha (Statistical Office of the Republic of Serbia, 2024). The use of mineral fertilizers amounted to an average of 448 kg/ha, while nutrient levels were nitrogen 125 kg/ha, phosphorus 39 kg/ha, and potassium 36 kg/ha. A positive correlation was observed between corn yield and the use of all nutrients, with nitrogen having the highest coefficient. In addition, assuming that the plant absorbs 19.3 kg of nitrogen per ton of yield, the average nitrogen loss is 27.87 kg/ha (Table 2). Nitrogen excess is not present in all areas but on 656 hectares (75% of the total sample). The total loss amounts to 18 tons of nitrogen, representing an economic loss for the farm and a potential environmental problem for society.

**Table 1:** Correlation between mineral fertilizers use and yields in crop production and nitrogen surpluses.

	Correlation N - Yield	Correlation P - Yield	Correlation K - Yield
Corn	0.7098	0.3579	0.5173
Wheat	-0.1304	-0.4221	-0.4221
Soybean	0.4719	0.2279	0.3432
Sunflower	-0.9336	-0.2501	-0.2663

**Source:** Author's calculation based on FADN, 2024.

A positive correlation is also present in the case of soybeans, although the coefficients are lower than in the case of corn. Soybean was produced on 546 hectares, with an average yield of 1.8 t/ha, slightly higher than Serbia and Vojvodina, 1.7 t/ha (Statistical Office of the Republic of Serbia, 2024). The average application of mineral fertilizer was 246 kg/ha (N-52 kg/ha; P - 31 kg/ha; K-29 kg/ha). If the plant absorbs 44 kg of nitrogen per ton of yield, the average nitrogen loss is 27.37 kg/ha, and the total loss is 3 tons. Unlike corn production, nitrogen losses occurred only on 82 hectares (15% of the total harvested area), which suggests that nitrogen fertilizers are used more efficiently in soybean production.

**Table 2:** Nitrogen surpluses in crop production.

	Average N loss per hectare (kg/ha)	Total N surplus (kg)	Area (ha) <sup>1</sup>
Corn	27.87	18,290	656
Wheat	39.45	3,266	82
Soybean	27.37	1,683	61
Sunflower	35.06	2,804	80
All	29.57	26,044	880

Source: Author's calculation based on FADN, 2024.

On the other hand, in the case of sunflowers, there is a negative correlation. This situation is most likely the result of bad weather conditions that did not allow adequate absorption of nutrients, but also bad management, as evidenced by nitrogen losses of 35 kg/ha. The average use of mineral fertilizer was 298 kg/ha (N-57 kg/ha; P-36 kg/ha; K-36 kg/ha). Sunflower was produced on 192 hectares, of which 80 hectares (42% of total harvested area) showed excessive nitrogen use. The average yield was 2.5 t/ha, corresponding to the average yields at the level of the state and Vojvodina (Statistical Office of the Republic of Serbia, 2024).

In the case of wheat, there is a negative correlation between yield and the use of mineral fertilizers. In addition, the highest nitrogen loss per hectare was recorded at 39 kg/ha. The average yield of wheat was 6.8 t/ha, significantly above the national average (4.9 t/ha) and the average in Vojvodina (5.4 t/ha). The use of mineral fertilizer amounted to 460 kg/ha, which testifies to extremely intensive production in this area. This sample includes 196 hectares under wheat, of which excessive nitrogen fertilizer use is noticeable on 82 hectares (41% of total area).

If the complete sample is observed, excessive nitrogen use occurred in 50% of the areas, creating surpluses of around 26 tons. This suggests that there is a space for improving nitrogen management to reduce economic losses and environmental consequences. Also, this signals the creators of agricultural policy in Serbia to devote special attention to solving this problem in the coming period.

## 4. CONCLUSIONS

Based on the research results, it is possible to conclude the following:

- Mineral fertilizer is a crucial factor in crop production, as evidenced by the approximation of the Cobb-Douglas production function. In this case, most output variations are determined by changes in mineral fertilizers and land use. These results are consistent with previous research.
- In the case of corn and soybean production, there is a positive correlation between the yield and the use of mineral fertilizer for each nutrient separately, while the correlation coefficient is negative in the case of wheat and sunflower. The absorption of the active substance from the mineral fertilizer is conditioned by weather, so it is possible that these crops' climate conditions were inadequate. This conclusion follows the critical limitation of this research, which is that the analysis was done only for one production year.
- Excessive use of nitrogen fertilizer is noticeable in all production lines. Nitrogen surpluses appeared in as much as 50% of the observed area. In addition to harmful effects on the farm's economic results, such surpluses also create a negative ecological effect.
- Following the results and achievements of modern agricultural policy, the creators of agricultural policy should pay special attention to the problem of using nitrogen fertilizers in Serbia when creating a new strategy.

Future research can go in several directions. First, it is necessary to extend the analysis to the regional or national level and increase the sample. Second, to better understand the effect of weather conditions, it is necessary to extend the analysis to a longer period, and it is recommended that at least three years be covered. Also, based on the available data within the FADN, it is essential to investigate the factors on the farm that influence excessive use of nitrogen fertilizers.

<sup>1</sup> It refers to the area where excess nitrogen use has appeared.

## 5. APPENDIX

Variable	Obs	Mean	Std. Dev.	Min	Max
Y	51	15.42597	.9064511	13.57484	17.24055
Labour	51	-.1575216	.6057271	-1.272966	1.064711
Land	51	3.367554	.8117444	1.526056	4.919981
Capital	51	14.92305	1.214902	12.44312	17.45612
Fertilisers	51	13.67472	.9277441	11.36326	15.61687

**Picture A1:** Descriptive statistics of variables

Source: Author's calculation based on FADN, 2024.

	Y	Labour	Land	Capital	Fertilisers
Y	1.0000				
Labour	0.6786	1.0000			
Land	0.9391	0.6817	1.0000		
Capital	0.6318	0.5410	0.6716	1.0000	
Fertilisers	0.9097	0.6436	0.8675	0.5411	1.0000

**Picture A2:** Correlation analysis of variables

Source: Author's calculation based on FADN, 2024.

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### **David Kranjac<sup>1</sup>**

Faculty of Agrobiotechnical Sciences Osijek,  
 Josip Juraj Strossmayer University of Osijek,  
 Osijek, Croatia  
 dkranjac@fazos.hr

### **Jaka Žgajnar<sup>2</sup>**

Biotechnical Faculty, University of Ljubljana,  
 Ljubljana, Slovenia

jaka.zgajnar@bf.uni-lj.si

### **Krunoslav Zmaić<sup>1</sup>**

Faculty of Agrobiotechnical Sciences Osijek,  
 Josip Juraj Strossmayer University of Osijek,  
 Osijek, Croatia  
 kzmaic@fazos.hr

### **Maja Petrač<sup>1</sup>**

Faculty of Agrobiotechnical Sciences Osijek,  
 Josip Juraj Strossmayer University of Osijek,  
 Osijek, Croatia  
 mpetrac@fazos.hr

### **Tihana Sudarić<sup>1</sup>**

Faculty of Agrobiotechnical Sciences Osijek,  
 Josip Juraj Strossmayer University of Osijek,  
 Osijek, Croatia  
 tihana.sudaric@fazos.hr

### **Marija Ravlić<sup>1</sup>**

Faculty of Agrobiotechnical Sciences Osijek,  
 Josip Juraj Strossmayer University of Osijek,  
 Osijek, Croatia  
 mravlic@fazos.hr

## **ASSESSING THE SERBIA EU INTEGRATION PROCESS IMPACTS ON KEY AGRICULTURAL MARKET PRODUCTS USING THE AGMEMOD MODEL**

**Abstract:** The EU integration process brings substantial transformations across all economic domains, agriculture included, as a result of shifts in both the economic and political landscapes. These processes necessitate numerous adjustments to legislation, agricultural support structures, business conditions within the single market, and the harmonization of domestic producer prices with those prevailing in the EU market. The impacts of these changes can be assessed utilizing partial equilibrium models such as the AGMEMOD model. While this paper primarily lays the methodological framework for constructing the Serbian national AGMEMOD model, upon its completion, it could serve as a valuable instrument for evaluating the effects of political changes on agricultural markets in Serbia, aligning with the evidence-based policy principle, similar to other EU member states

**Keywords:** AGMEMOD model, modelling approach, agricultural markets, Serbia

## **1. INTRODUCTION**

The European Union (EU) officially recognized the European perspective for all Western Balkan countries in June 2003, with Serbia applying for EU membership in December 2009, granted candidate status by the European Council in March 2012, and initiating accession negotiations in June 2013. From the agricultural sector standpoint, this implies that the Common Agricultural Policy (CAP) serves as the model for shaping Serbia's forthcoming agricultural policies (Erjavec et al., 2021). Institutional reforms are necessary to harmonize the legal and administrative structures of candidate countries with those of the EU in order to integrate the agricultural sector into the EU single market. After accession, candidate countries are required to demonstrate proficiency in managing the CAP policy cycle, which encompasses planning, distributing support payments, monitoring, evaluating, and participating in the development of the CAP support system.

The use of economic models to evaluate the effects of a new member state's accession to the EU on its agricultural sector and overall economy is a well-established practice endorsed by both the European Commission and the scientific community (Gohin and Zhang, 2020). Common tools used in such studies include Computable General Equilibrium (CGE) models, Partial Equilibrium (PE) models, and Farm management-type models (Žgajnar et al., 2021) available through the European Commission's IMAP platform (Bartova and M'Barek, 2008; Erjavec et al., 2011; Boulanger and Philippidis, 2015; Boysen et al., 2016; Niemi and Kettunen, 2018; Kranjac et al., 2020). This platform aims to provide robust scientific evidence supporting the implementation, monitoring, and evaluation of the CAP (M'barek and Delincé, 2015).

The AGMEMOD (Agricultural Member State Modelling) is a dynamic, econometric, multi-product, and multi-country PE model, frequently used for generating medium-term simulations of agricultural market outlooks and assessments of policy impacts for both EU member states, candidate countries, and other countries (Salamon et al., 2019). Additionally, alongside CAPRI and AGLINK, AGMEMOD stands as one of the three principal PE models within the IMAP platform. Using the AGMEMOD model, successful research and studies have been conducted thus far on the impact of a particular country's accession to the EU on its agricultural sector, exploring how changes in the political and economic environment affect key agricultural product markets (Kranjac et al., 2020; Kotevska et al., 2013; Van Leeuwen et al., 2011; Gavrilesco et al., 2006; Erjavec et al., 2006).

The objective of this paper is to initiate research on the impact of Serbia's accession to the EU on its key agricultural product markets using the AGMEMOD model. The paper will present the AGMEMOD methodology, assumptions, and the potential development of an AGMEMOD country template for Serbia, which is intended to serve as a baseline scenario for comparing the effects of changes on key agricultural product markets in the future. Additionally, the limitations of this type of research using partial equilibrium models will be discussed.

## 2. AGMEMOD PE MODEL

Partial equilibrium models are extensive market models that delineate particular sub-sectors or clusters of agricultural sub-sectors, delving deeply into the intricacies of supply and demand dynamics, price establishment, the interplay of agricultural inputs and outputs across various product lines, the effects of policies on supply, and producers' income, among other factors. These models are grounded in the neo-classical approach, wherein supply and demand reach equilibrium as producers and consumers strive to maximize profits and product utility.

AGMEMOD utilizes a series of commodity-specific model templates which make a country-specific models which are constructed to capture the intricacies of agriculture at the Member State or Country candidate level while enabling their integration into an EU-wide model (Salamon et al., 2017). Maintaining strict adherence to these templates ensures analytical coherence among the country models, thereby facilitating aggregation towards an EU-level analysis. This adherence to model templates and a unified modelling approach also streamlines the comparison of policy impacts across diverse Member States. The primary purpose of the AGMEMOD model is to create mid-term simulations of key agricultural product markets (Outlooks) and to conduct scenario analyses to assess the impact of future changes in the political environment on these observed key agricultural markets (Kranjac, 2020). Mid-term outlooks of key agricultural product markets and scenario analyses can serve as the basis for evidence-based policymaking (Colen et al., 2016).

In order for the model to satisfy the condition of partial equilibrium, it is necessary to establish market equilibrium at each individual key market, which implies equality at a certain price level for the product. Which can be shown by the following general equation:

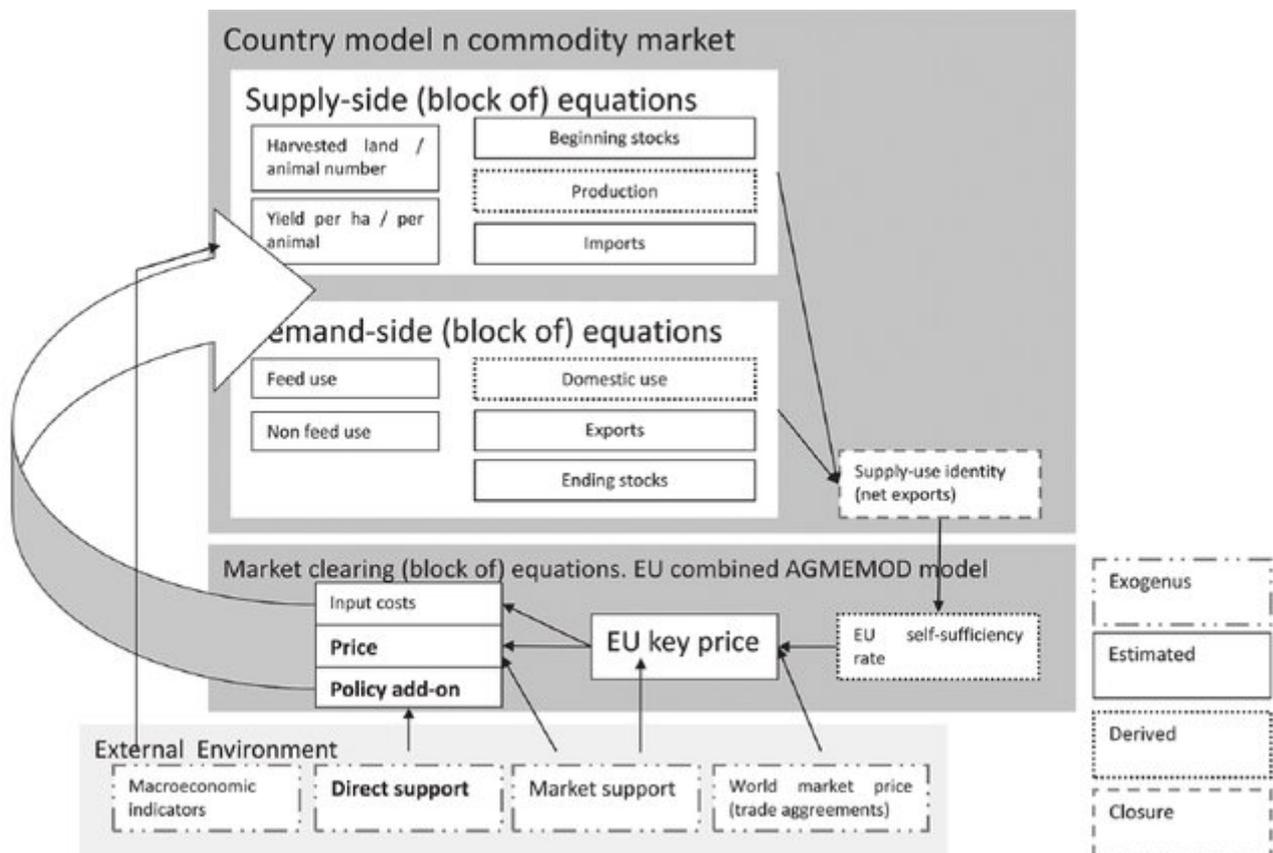
$$Production_t + Import_t + Beginning\ stocks_t = Consumption_t + Export_t + Ending\ stocks_t \quad (1)$$

### 2.1. Data, structure and modelling approach within the AGMEMOD model

AGMEMOD is also a composite model whose modeling approach (bottom-up) is based on combining sub-models of key agricultural product markets into a template of a national model. The national template of the AGMEMOD model is constructed according to the EU Gold model template (Hanrahan, 2001). Subsequently, the national models of member states are combined into a single EU 28 model (Chantreuil et al., 2012).

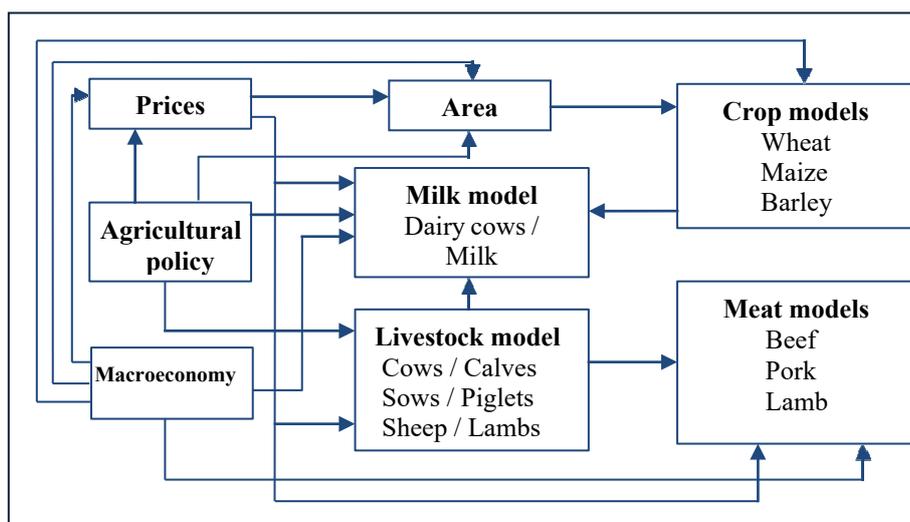
The fundamental data for the key agricultural product markets consist of production-consumption balances for all observed key markets, including annual data on initial stocks, production, imports, human and animal food consumption, industrial consumption, exports, ending stocks, and domestic prices. The source for these data is relevant national databases such as the National Statistical Offices and the FAO or EUROSTAT database. These data represent endogenous data contained within the model. In addition to endogenous data, the model includes exogenous data such as macroeconomic and political variables and data on world market prices of key agricultural products. Macroeconomic variables contain data on inflation rates, per capita income, population, exchange rates, etc. Political variables encompass sets of data on regional and historical payments, coupled supports, production-related subsidies, state aids, etc.

Supply and demand, international trade, and domestic prices are endogenously determined within each sub-model, while changes in exogenous variables (macroeconomic variables, political instruments) cause changes in the behavior of producers and consumers within the key agricultural product market (Chantreuil et al., 2012). Using sets of econometrically estimated equations, the model generates projections of endogenous variables from exogenous and endogenous model data. Thus, the national AGMEMOD model dynamically represents changes in the behavior of stakeholders (producers and consumers) in response to exogenous changes within key agricultural product markets (Picture 1).



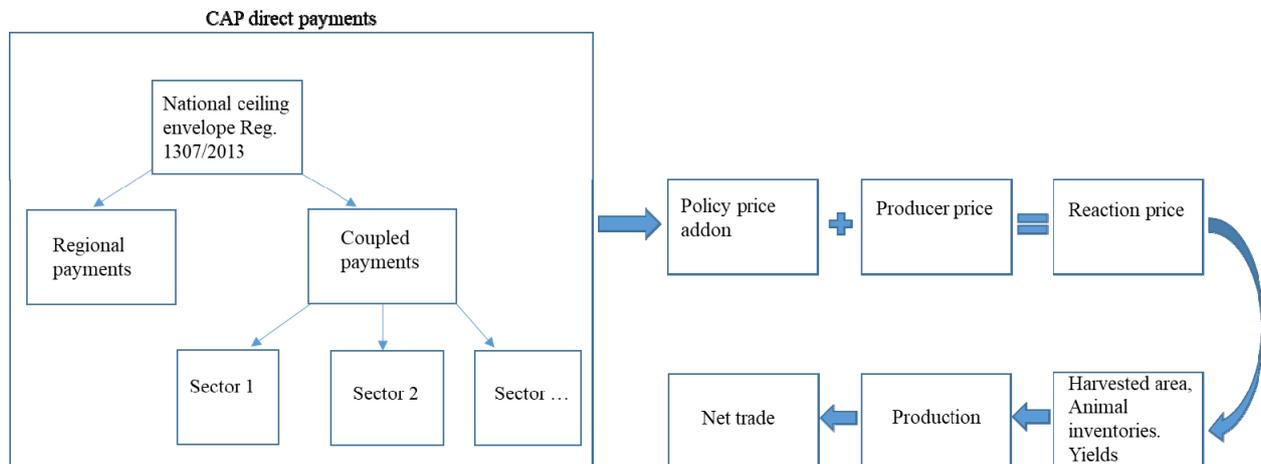
Picture 1. AGMEMOD country model template  
Source: According to Chantreuil et al., 2012

Key agricultural market products are modeled in the interdependence of crop and livestock production, reflecting competition among substitution products through elasticity and different interactions between crop and livestock markets (Picture 2). The crop models are interconnected by allocating the total arable land utilized for crops and their prices, as they serve as inputs in livestock production. Additionally, crop models are interconnected by utilizing grains as feed in livestock models. Conversely, the quantity of livestock production determines the demand for grains as animal nutrition. The connection between meat models is established based on their relative prices, assuming they act as partial substitutes. The milk model is associated with the beef model through the total number of cows.



Picture 2. AGMEMOD sub-model interactions  
Source: According to Kotevska et al., 2013

Political instruments in the model are represented through a policy harmonized approach, which involves incorporating current measures and instruments of the recent CAP reforms, delineating various direct payments, regional, historical and coupled payments, as well as distinct national policies prior to accession and the topping-up rates in the new member states (Salputra et al., 2011). Regional, production-related payments, as well as state aids, are recalculated and included as an addition to producer prices for each observed agricultural product market, in order to form a reaction price that influences production levels, cultivated areas, average slaughter weights, and numerous other variables in the national AGMEMOD model (Picture 3). Rural development measure funds are not included in the model, as models of this type are unable to incorporate second pillar supports of agricultural policy.



Picture 3. Policy-harmonised approach within the AGMEMOD model  
Source: According to Kranjac et al., 2021

The following shows the general form of the econometric equation, according to which the model establishes output variables or the regression function through which the regression coefficients of the model are calculated.

General layout of the model equation:

$$Y = f(X_1; X_2; X_3) \tag{2}$$

Where:

$Y$  = dependent indicator, which in specific equations can be, for example, yield, production, area, etc.

$X_1; X_2; X_3$  = variables that represent independent factors that have an impact on the change of the dependent indicator

It can also be written as:

$$Y = \alpha + \varepsilon\beta_1 X_1 + \varepsilon\beta_2 X_2 + \varepsilon\beta_3 X_3 \dots + \epsilon \tag{3}$$

Where:

$Y$  = dependent indicator

$\alpha$  = intercept

$\varepsilon$  = coefficient of elasticity

$\beta$  = regression coefficient

$X_{123}$  = independent factors that have an influence on the change of the dependent indicator

$\epsilon$  = error term

### 3. SERBIAN NATIONAL AGMEMOD TEMPLATE

In order to assess potential impacts of Serbia's accession to the EU on its key agricultural product markets it is necessary first to develop Serbian national template in AGMEMOD model.

The process of developing the Serbian AGMEMOD national model includes:

- Input data entry (endogenous and exogenous) into the model
- Setting up and estimating econometric behavioral equations
- Model calibration
- Model evaluation through statistical tests and expert assessments

Following the input of input data, econometric behavioral equations are set up for all major indicators (production, imports, exports, yields, etc.) within the key agricultural product markets of the Serbian national AGMEMOD model. Depending on the set of equations, it is necessary to define a set that reflects supply (initial stocks, production, and imports) and demand (domestic consumption, exports, and closing stocks) in the key market. Both sets of econometric equations determine how market equilibrium is achieved in a given year at a specific price for each product. Econometric behavioral equations are estimated according to the appropriate econometric methodology specified by the general rules of the AGMEMOD modeling approach (Hanrahan, 2001).

After estimating the econometric equations, the Serbian model is to be calibrated to achieve a better representation of the real situation in key agricultural markets. The calibration process involves re-estimating econometric behavioral equations to align regression coefficients in equations so that projected variables are consistent with economic theory, biological constraints, and standard statistical tests. Generally, calibration techniques are used for shorter time series of input data (balance data), as is the case in constructing the Croatian model (Kranjac et al., 2020). In addition to shorter input data series, calibration is performed due to structural declines in production caused by policy changes and economic crises, as well as occasional poor-quality balance data from the State Bureaus of Statistics.

Model evaluation in terms of testing the significance of regression parameters is conducted through the T-test, followed by testing the significance of the entire regression through the F-test with the coefficient of determination  $R^2$ . Estimated results are then evaluated with standard statistical tests for heteroscedasticity (White heteroscedasticity) and autocorrelation (Durbin-Watson test) (Bartova and M'barek, 2008).

In addition to statistical model evaluation, the Serbian model has to be evaluated by experts in two steps. In the first step, an international expert in key agricultural markets (agricultural economist) verifies the consistency of the estimated econometric equations. Then, at least two domestic experts specialized in domestic agricultural product markets, one specializing in crop markets and the other in livestock markets, have to assess the initial baseline simulation of the model with feedback on the projections made. Based on the experts' comments on individual projections of key agricultural product market variables, additional calibration of regression coefficients in equations will be carried out. For the complete development of the Serbian AGMEMOD template, it is necessary to separately develop crop and livestock sub-models and then incorporate them into the Serbian national AGMEMOD model of partial equilibrium of key agricultural product markets. Once the Serbia national AGMEMOD model template is developed according to the AGMEMOD modeling approach, then it can be integrated into the common EU AGMEMOD model.

### 3.1. Approach to the modelling of the Serbian crop model within AGMEMOD

The first step in developing the crop model involves modeling the total areas occupied by cereals, oilseeds, and tuber and root crops. The shares of total areas are allocated to individual groups (cereals, oilseeds, tuber and root crops), and the projected redistribution of land among crop groups depends on the expected gross return rate, while the allocation of land for the production of each product depends on the relative real gross return rate, including direct payments.

Therefore, the equation for the total harvested area of cereals, oilseeds, tuberous and root crops can be written as:

$$ah_{i,t} = f(p_{i,t-1}^j, ah_{i,t-1}, V) \quad j = 1, \dots, n; \quad i, l = 1, \dots, 3; \quad i \neq l \quad (4)$$

Where:

$ah_{i,t}$  = harvested area in year  $t$  of crop group  $i$

$p_{i,t-1}^j$  = real price of crop  $j$  belonging to crop group  $i$  in year  $t-1$

$V$  = vector of exogenous variables that can affect the harvested crop area  $i$  (e.g. certain policy instruments such as coupled payments).

The share of crop  $k$  belonging to the crop group is determined according to the equation:

$$sh_{i,t}^k = f(p_{i,t-1}^j, sh_{i,t-1}^k) \quad j, k = 1, \dots, n \quad (5)$$

The share of the harvested area of a particular crop is calculated according to the principle 1 - part of the areas of all other  $(n-1)$  crops, which means that the harvested area of the crop = total harvested area \* share of the  $n$  crop.

The yield of crop  $k$  which is in the crop group  $i$  is expressed as:

$$r_{i,t}^k = f(p_{i,t-1}^j, r_{i,t-1}^k, V) \quad j, k = 1, \dots, n \quad (6)$$

Where:

$r_{i,t}^k$  = yield per hectare of crop  $k$  which is in the crop group  $i$

$p_{i,t-1}^j$  = real price of crop  $j$  belonging to crop group  $i$  in year  $t-1$

$r_{i,t-1}^k$  = yield per hectare of crop  $k$  which is in crop group  $i$  in year  $t-1$

$V$  = vector of exogenous variables that can affect the yield per hectare of crop  $k$  located in crop group  $i$ .

Based on the previous equations, the production of each crop is determined: crop production = harvested crop area \* crop yield.

The following set of equations shows how consumption is modelled in the crop model. Consumption in the crop model includes three segments: processing, animal feed and human consumption (per capita), and is modelled according to the following equations:

$$FU_{i,t}^k = f(p_{i,t}^j, Z) \quad j, k = 1, \dots, n \quad (7)$$

Where:

$FU_{i,t}^k$  = consumption of crop  $k$  belonging to crop group  $i$  for fodder

$p_{i,t}^j$  = real price of crop  $j$  belonging to crop group  $i$  in year  $t$

$Z$  = vector of endogenous variables that can influence feed consumption (e.g. meat production).

$$NFU_{i,t}^k = f(p_{i,t}^j, NFU_{i,t-1}^k, V) \quad j, k = 1, \dots, n \quad (8)$$

Where:

$NFU_{i,t}^k$  = Consumption of crop  $k$  belonging to the crop group  $i$  for human consumption

$p_{i,t}^j$  = real price of crop  $j$  belonging to crop group  $i$  in year  $t$

$NFU_{i,t-1}^k$  = Consumption of crop  $k$  belonging to crop group  $i$  for human consumption in year  $t-1$

$V$  = vector of exogenous variables that can affect human consumption (e.g. total population).

$$Cr_{i,t}^k = f(p_{i,t-1}^h, p_{i,t-1}^l, Cr_{i,t-1}^h, VZ) \quad h, k, l = 1, \dots, n \quad (9)$$

Where:

$Cr_{i,t}^k$  = processing of oilseeds of crop  $k$  belonging to the crop group  $i$  for the production of oil and oil cakes in the year  $t$

$p_{i,t-1}^h$  = the actual price of the oil of crop  $h$  belonging to the crop group  $i$  in the year  $t-1$

$p_{i,t-1}^l$  = the real price of the oil cake of crop  $l$  belonging to the crop group  $i$  in the year  $t-1$

$Cr_{i,t-1}^h$  = processing of oilseeds of crop  $h$  belonging to the crop group  $i$  for the production of oil and oil cakes in the year  $t-1$

$VZ$  = vectors of endogenous and exogenous variables that can affect the amount of processing (e.g. imports, oil extraction).

The equations of stocks, imports and exports in the farming and livestock models have the same following form, and are expressed as follows:

$$St_{i,t}^k = f(Pr_{i,t}^k, Du_{i,t}^k, St_{i,t-1}^k) \quad (10)$$

$$Ex_{i,t}^k = f(Pr_{i,t}^k, Du_{i,t}^k, Ex_{i,t-1}^k) \quad (11)$$

$$Im_{i,t}^k = f(Pr_{i,t}^k, Du_{i,t}^k, Im_{i,t-1}^k) \quad (12)$$

Where:

$St_{i,t}^k, Ex_{i,t}^k, Im_{i,t}^k$  = stocks, export and import of crop  $k$  belonging to crop group  $i$  in year  $t$

$Pr_{i,t}^k$  = total domestic production of crop  $k$  belonging to crop group  $i$  in year  $t$

$Du_{i,t}^k$  = total domestic consumption of crop  $k$  belonging to crop group  $i$  in year  $t$

$St_{i,t-1}^k, Ex_{i,t-1}^k, Im_{i,t-1}^k$  = stocks, export and import of crop  $k$  belonging to crop group  $i$  in year  $t-1$ .

### 3.2. Approach to the modelling of the Serbian livestock model within AGMEMOD

Similarly, to the crop model, the general form of equations in the livestock model illustrates the way in which supply and demand are modeled. The first set of equations represents the way in which supply is modeled.

The number of breeding animals (breeding herd) is modelled by the following equation:

$$cct_{i,t} = f(cct_{i,t-1}^k, p_{i,t}, V) \quad k = 1, \dots, n \quad i = 1, \dots, n \quad (13)$$

Where:

$cct_{i,t}$  = number of breeding animals  $i$  in year  $t$

$cct_{i,t-1}^k$  = ending stocks of breeding animals  $i$  within type of breeding animal  $k$  in year  $t-1$

$p_{i,t}$  = the real price of a breeding animal  $i$  in year  $t$

$V$  = vector of exogenous variables that can affect the final stocks of breeding animals  $i$

The number of animals produced from the breeding herd can be expressed as follows:

$$spr_{i,t} = f(cct_{i,t-1}, ypa_{i,t}) \quad i = 1, \dots, n \quad (14)$$

Where:

$spr_{i,t}$  = number of animals  $i$  produced from breeding herd in year  $t$

$cct_{i,t-1}^k$  = final stocks of breeding animals  $i$  within type of breeding animal  $k$  in year  $t-1$

$ypa_{i,t}$  = yield per animal from the breeding herd in year  $t$

Within each animal species  $i$  there may be  $m$  categories of slaughtering  $j$ . The number of animal species  $i$  slaughtered in slaughtering category  $j$  can be expressed as:

$$ktt_{i,t}^j = f(cct_{i,t}^j, p_{i,t}, z_{i,t}^j, V) \quad i = 1, \dots, n \quad j = 1, \dots, m \quad (15)$$

Where:

$ktt_{i,t}^j$  = the number of slaughtered animals in the category  $j$  animal species  $i$  in the year  $t$

$cct_{i,t}^j$  = ending stocks of animal species  $i$  within species of slaughtered animals in category  $j$  in year  $t$   $p_{i,t}$  = real price of animal species  $i$  in year  $t$

$z_{i,t}^j$  = endogenous variable representing the proportion of different categories of slaughtered animals for the respective animal species

$V$  = vector of exogenous variables that can affect the number of slaughtered animals

Average slaughter weight in animal species  $i$  can be expressed as:

$$slw_{i,t} = f(slw_{i,t-1}, p_{i,t}, z_{i,t}^j, V) \quad i = 1, \dots, n \quad j = 1, \dots, m \quad (16)$$

The total production of meat from an animal species  $i$  is calculated as the result of the average slaughter weight multiplied by the total slaughtering within the same species of slaughtered animals, and can be expressed as:

$$ktt_{i,t} = \sum_j ktt_{i,t}^j \quad i = 1, \dots, n \quad j = 1, \dots, m \quad (17)$$

The total domestic consumption of a certain type of meat is calculated by the consumption of meat per capita multiplied by the total number of the population. Consumption of a certain type of meat per capita is calculated as:

$$upc_{i,t} = f(upc_{i,t}, p_{i,t}, p_{k,t}, gdpc_t, V) \quad k, i = 1, \dots, n; \quad k \neq i \quad (18)$$

Where:

$upc_{i,t}$  = meat consumption per capita of animal species  $i$  in year  $t$

$p_{i,t}, p_{k,t}$  = real price of animal species  $i, k$  in year  $t$

$gdpc_t$  = real income per capita in year  $t$

$V$  = vector of exogenous variables that can influence meat consumption per capita

### 3.3. Scenario development

In order to measure effects of protentional impacts of the integration processes on Serbian key agricultural market products, several scenarios within AGMEMOD model could be developed similar to scenarios presented in Kotevska et al. (2013):

- 1) *Baseline scenario* - It embodies the scenario of 'no policy change,' serving as a counterfactual to discern the impacts on Serbian agricultural markets and to provide a benchmark against which policy change simulations

can be assessed. It assumes no accession to the EU and no alteration in policy measures, yet incorporates an augmentation of the budget allocated for agricultural support in line with the plans and projections outlined by the Serbian Ministry of Agriculture.

- 2) *Price convergence scenario* - envisions EU accession until the end of decade and the adjustment of prices for covered commodities to align with the integration into the common European market.
- 3) *EU-optimistic scenario* - anticipates EU accession until the end of decade, along with price adjustments and the implementation of CAP rules under optimistic assumptions regarding budget allocations and permissible measures. These include a national ceiling in line with Serbian Ministry of Agriculture, a topping-up rate from the national budget similar to Croatia's case in 2013, levels of direct payments for arable land, and perennial crops, coupled payments for beef and lamb, and the absence of historical payments.
- 4) *EU-pessimistic scenario* - anticipates EU accession until the end of decade, alongside price adjustments and the implementation of CAP with a constrained budget and limited policy measures. This includes a national ceiling set at 75%, a fixed topping-up rate from the national budget at 30% and the absence of coupled and historical payments.

## 4. CONCLUSION

Modelling the agricultural sector has emerged as a beneficial method for forecasting market trends and evaluating policy impacts. While partial equilibrium models are frequently employed in agricultural sector modelling, practitioners encounter various advantages and disadvantages associated with their utilization.

Challenges in data acquisition frequently emerge as a constraining factor. Primarily, this is attributed to the demanding nature of the database required by the model. Additionally, the transition process and subsequent institutional reforms have necessitated changes in the statistical methodology of data collection, leading to issues with data availability. The availability and reliability of data subsequently impact the process of parameter estimation and model validation.

Expert opinions and assumptions are utilized to supplement missing segments and establish *ceteris paribus* factors. However, efforts to minimize the level of subjectivity in forming assumptions are often challenging, particularly when consulting a limited number of experts whose scientific perspectives are weighed by individual analysts.

The quality of assumptions delineating the operational environment in agriculture significantly influences the utility of the model results. Moreover, the effectiveness of representing linkages with other agricultural sectors and the broader economy largely depends on the quality of the assumptions they are underpinned by.

Generally, caution should be exercised when interpreting the modelling results, as they cannot serve as the sole basis for decision-making by policymakers. Therefore, decision-making process should be complemented by an assessment of various economic models and other agricultural policy assessment methods.

One of the primary benefits of AGMEMOD as a partial equilibrium sectoral model lies in its capacity to apply a policy-harmonized approach, which allows for the connection or disconnection of specific policy instruments to or from individual agricultural commodities. This capability facilitates a quantitative examination of how policy modifications influence both the markets and the production composition within the examined agricultural sectors. Although this paper serves solely as a methodological background for development of the Serbian national AGMEMOD model, once fully developed, it could serve as a valuable tool for assessing the impacts of political changes on agricultural markets in Serbia like in other EU member states, following the evidence-based policy principle.

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**Miriama Blahušiaková**

Department of Accounting and Auditing,  
Faculty of Economic Informatics,  
University of Economics in Bratislava,  
Bratislava, Slovakia

miriama.blahusiakova@euba.sk

## **CORPORATE SOCIAL RESPONSIBILITY AND THE IMPORTANCE OF ESG REPORTING FROM THE YOUNG GENERATION PERSPECTIVE**

**Abstract:** Since the adoption of the Non-Financial Reporting Directive, companies are required to report information on environmental, social, and employee matters, respect for human rights, anti-corruption, and bribery matters. These aspects represent some of the elements of socially responsible corporate behavior.

Following the adoption of the Corporate Sustainability Reporting Directive and its gradual transposition into the European Union Member States' national legislation, the ESG reporting requirements are becoming stricter. The aim is to ensure transparency and comparability of reported sustainability information, to prevent greenwashing, and to ensure that companies behave in a socially responsible manner to the environment, society, and governance, and report this information in the Sustainability Report.

The paper aims to analyze how the young generation from four different countries perceives the socially responsible behavior of companies and what importance they give to different aspects of corporate social responsibility.

To meet the purpose of the paper, a standard methodology of legislation and literature review was performed.

Afterward, a questionnaire survey was conducted in which we investigated the attitudes of the young generation to the socially responsible behavior of companies.

The results of the research showed that the young generation perceives social responsibility in companies' behavior and takes it as a competitive advantage in the market. The results, among others, showed which aspects of responsible business are the most important for the young generation, if young people can name some socially responsible companies, and if they prefer to buy products or services from companies that behave responsibly to society and the environment, etc.

The paper analyses the attitudes of the young generation which can be a limited factor in the research. More detailed analysis within all the age groups could bring different results. The number of respondents is another limitation.

**Keywords:** ESG reporting, Corporate social responsibility, ESRS, CSRD, Green Deal, sustainability

### **1. INTRODUCTION**

The expansion of the world economy, which intensified after the Industrial Revolution, led to pressures on the use of natural resources, the growth in the production of consumer goods, the conversion of forests and grasslands into built-up areas, and an increase in urbanization. Such development has had (Taghvaei et al., 2022) a positive impact on the livelihoods of society, however, on the other hand, its impact and demand on natural resources have raised considerable concerns about this transition. The lack and depletion of resources, climate change, pollution, and degradation of the environment, as well as increasing amounts of greenhouse gases leading to global warming, forced governments all around the world to consider sustainable development. The future of the planet and mankind has become a priority for economies, governments, and communities. Companies are aware of the potential impact of their activities on the

environment, society, or employees and are beginning to actively minimize these impacts and look for opportunities to innovate. As a result, we can see an increase in the sustainable activities of companies, and pressure on their environmental and social behavior to protect the environment and create good conditions for living.

As Kidd (1992) states, since the 1950s, six separate but related strands of thought have emerged in discussions of the interrelationships among population growth rates, resource use, and environmental pressures. They are the ecological/capacity root, the resource/environment root, the biosphere root, the technology critique root, the 'no growth'/slow growth' root, and the ecological development root. All these roots were fully developed before the term "sustainable" itself was used. Sustainability and sustainable development have stimulated intense scientific and public debate since their international discovery in the Brundtland Commission Report in 1987 in which the overall concept of sustainable development was defined for the first time (Diaz–Sarachaga, 2021; Boyer et al., 2016). After this, the term sustainability, despite not having a specific definition, became very popular (Silva et al., 2022) and many definitions of the term sustainability have appeared (Basile et al., 2021; Ruggerio, 2021).

The aim of the paper is to analyze how the young generation from four different countries perceives the socially responsible behavior of companies and what importance they give to different aspects of corporate social responsibility. To meet the objective of the paper we have studied relevant sources of literature, as well as the legislation related to the area of sustainability and ESG reporting. We have studied mainly academic papers obtained from the database Web of Science, SCOPUS, as well as professional papers from websites of the biggest accounting and auditing organizations, and professional bodies. Our literature review was based on the legislation as of March 31, 2024. Subsequently, we conducted a questionnaire survey in six faculties from universities in four countries to investigate, analyze, and compare the perception of sustainability among the younger generation.

## 2. THE TRIPLE BOTTOM LINE OF SUSTAINABILITY

IISD (1992) defines corporate sustainability as "business strategies and activities that meet the needs of the enterprise and its stakeholders today while protecting, sustaining, and enhancing the human and natural resources that will be needed in the future". According to Basile et al. (2021), sustainability has become one of the key factors for long-term business success. The implementation of sustainability principles has been pursued by companies worldwide, not only because it is a key factor for the livelihood of companies, but also because it is essential for the survival of future generations (Silva et al., 2022). Companies are required to manage their businesses with respect for the environment, to have good relationships with their customers, suppliers, employees, and business partners, and to act in harmony with the needs of the local community. Taghvaei et al. (2022) point out that sustainability means creating the conditions for humanity and nature to coexist in productive harmony, enabling the socio-economic development of present and future generations.

Thus, sustainability is not just about environmental matters. Sustainability is based on three pillars, economic, environmental, and social which interact in harmony. According to Boyer et al. (2016), these three dimensions form what is currently known as the tripod of sustainability, or "the Triple Bottom Line" (TBL). The economic pillar has been the pillar that all companies have continuously and increasingly tried to improve before because generating profit is the main purpose of business. Nowadays, the companies show to society in general, and the market in particular, the respect they have for the social and environmental pillars of sustainability (Silva et al., 2022). If a company generates profit, it can contribute to achieving social and environmental goals. In addition to their economic goals (Maas & Boons, 2010), companies raise awareness of the environmental and social impacts resulting from their activities.

According to Estoque & Murayama (2014), the three components of the Triple Bottom Line of Sustainability (TBLS) represent a nested hierarchy because societies cannot thrive without a functioning life support system, and economies cannot thrive without functioning social structures and institutions. The economic pillar is based on running a business to generate positive financial results of a company. This is considered the essential pillar of TBL. Without profit, there would be no investments in technologies protecting the environment, and no investments into improving working conditions, quality of life, leisure, and security. The environmental pillar is based on behavior and activities that protect the environment (Santos, Gouveia, & Silva, 2017; Purvis et al., 2019; Bravi et al., 2020). Environmental protection, natural resource conservation, decreasing greenhouse gases, use of renewable sources, reduction of solid waste emissions, and recycling trash are some aspects that belong to the environmental pillar of TBL. The third pillar of TBL, the social pillar, is related to the social factors, including working conditions, equality, non-discrimination, diversity and inclusion, human rights, and the development of better policies in areas such as education, leisure, and security (Silva et al., 2022).

According to Ruggerio (2021), the concept of sustainability is often associated with the concept of sustainable development and thus both terms are used as synonyms. WCED (1987) defines sustainable development, also known as sustainable economic development, as a development that meets the needs of the present, without compromising the ability of future generations to meet their own needs. Governments in many countries are also becoming increasingly aware of their responsibility to ensure sustainability. They are requiring project companies to develop strategies and action plans that will contribute to sustainable development (Aarseth et al., 2017). According to Székely and Knirsch (2005), economic growth, shareholder value, firm reputation, and customer relationships are the main attributes of corporate sustainability. Bansal (2005) defines sustainability at the corporate level as economic prosperity, social justice, and environmental protection through value creation, corporate social responsibility, and corporate environmental management. According to Rašić-Jelavić, & Pajdaković-Vulić (2021), the level of incorporating sustainability in business

objectives and strategy will depend, among others, on environmental context, and external incentives (the industry type and sector, environmental legislation, market demand for environmentally friendly products, social demand, the demand of responsible investors, etc.), and internal motives (image improvement, brand improvement, marketing improvement, increase in sale of environmentally-friendly products, resource productivity improvement, risk control, better employee motivation, better competitiveness, etc.).

### 3. ESG REPORTING REGULATIONS

Presenting information on the social and environmental dimensions of companies plays a key role in the sustainable development of organizations (Bednářová & Bonsón, 2014). Serious concerns about the future of mankind have inspired governments, companies, and investors to make sustainability a top business priority. As part of the European Green Deal, the European Union (EU) has started the green transformation by redirecting private capital into green investments, leading organizations towards more sustainable ways of operating and financing. The aim was to foster economic growth while reducing pressure on the environment, helping to achieve the EU's climate and environmental goals, taking into account social and governance aspects. Considering the impact on the environment and society is also important for keeping businesses competitive and building their resilience to the effects of climate change (Škyrta & Semjanová, 2024). Nowadays, we can see the shift from traditional reporting based mostly on financial data to new forms of reporting based on the TBL approach that includes corporate social responsibility (CSR) disclosure.

In the beginning, and over the past three decades, CSR reporting was voluntarily based. Some organizations presented their sustainable information within annual reports where they often presented only the minimum information. Much more information was presented on the websites of companies. As the praxis proved, the companies have used to provide basic information for each of the pillars of TBL (impact on the environment, social, and employment area) but do not always provide all the information on a point-by-point basis. Companies have applied various standards and regulations regarding CSR reporting. The most popular standards in the European Union are the Global Reporting Initiative (GRI), the Sustainability Accounting Standards Board (SASB), The Task Force on Climate-related Financial Disclosures (TCFD), the EU Taxonomy, etc.

Over the past decades (Noronha et al., 2013), the importance of CSR behavior of companies and the need for CSR reporting arose as a response to many corporate scandals, financial crises, climate change, the commitment to a lower-carbon future and concern about labor rights, product safety, poverty reduction.

In 2014, *Directive 2014/95/EU of the European Parliament and of the Council of 22 October 2014 amending Directive 2013/34/EU as regards disclosure of non-financial and diversity information by certain large undertakings and groups*, also known as Non-financial Reporting Directive (NFRD) amended the provisions of *Directive 2013/34/EU of the European Parliament and of the Council of 26 June 2013 on the annual financial statements, consolidated financial statements and related reports of certain types of undertakings, amending Directive 2006/43/EC of the European Parliament and of the Council and repealing Council Directives 78/660/EEC and 86/349/EEC*. NFRD has required large companies (public-interest entities) with more than 500 employees to prepare a non-financial statement reporting non-financial information related to sustainability, environmental, social, and employee matters, and respect for human rights. The non-financial statement should contain information on the current and foreseeable impacts of the company's operations on the environment, on the health and safety of employees, information on the use of renewable and non-renewable energy, greenhouse gas emission, water use, and air pollution, information on actions taken to ensure gender equality, working conditions, respect for the right of workers to be informed, information on anti-corruption, and bribery matters, etc.

Martínez et al. (2016) state that sustainability reporting has over the years established itself as a key tool to help companies and organizations meet the growing demand for transparency from customers, investors, other stakeholders, and society at large. Through non-financial (sustainability) reports, organizations disclose information on the economic, environmental, and social impacts of their activities. This leads to increasing transparency on their sustainability performance. According to Girón et al. (2021), this increased transparency provides investors with the possibility to make more appropriate valuations and to better orient their investments towards companies with a more positive impact. According to stakeholder theory (Gray et al., 1995; Adams & Larrinaga-González, 2007), the disclosure of financial (economic), environmental, and social information is a part of the dialogue between the company and its stakeholders. It provides information on a company's activities that legitimize its behavior, and inform and change perceptions and expectations. Michelon & Parbonetti (2012) investigated the effects of good corporate governance on sustainability disclosures and claimed that sustainability reporting may be a function of board attributes.

Over the past decade, CSR reporting, or Environmental, Social, and Governance (ESG) reporting has gained even higher importance. The concept of ESG was first introduced by the United Nations in its 2006 Principles for Responsible Investment. According to Škyrta & Semjanová (2024), ESG sets out criteria and standards for companies' environmental and social performance and their governance and management. The ESG concept itself is based on corporate social responsibility and reflects the need for investors and other stakeholders to gain insight into the environmental, governance, and social behavior of companies.

ESG reporting is connected with CSR, which role in improving corporate financial situation, and reputation, and attracting potential investors is becoming more important (Salehi et al., 2019; Yang et al., 2018). Therefore, it is important to

remember that sustainability refers to the ability to maintain or support a process or activity over time. It is based on economic, environmental, and social pillars and considers the preservation of life and natural resources for future generations. While sustainability can be viewed primarily through various forms of reducing the negative impact of companies' actions on their surroundings, the ESG field is specific and measurable. According to KPMG (2024), ESG is a framework that helps investors evaluate a company's risk, performance, and impacts based on environmental, social, and governance criteria. Sustainability, on the other hand, is a principle that promotes responsible and ethical business practices by taking into account the interplay of environmental, social, and economic factors.

Companies' stakeholders, including customers, employees, communities, investors, policymakers, and regulators, increasingly demand better sustainability performance and disclosures from companies, greater accountability and transparency for their impacts on society and the environment (Accountancy Europe, 2023). Incorporating sustainability considerations into strategic decisions, operations, value chains, and company culture is the pragmatic approach to secure the business' future existence.

Companies that report ESG matters are more likely to gain a competitive advantage, benefit from commercial and business opportunities, improve their ESG performance, and ultimately create long-term value for stakeholders. Better ESG performance can help companies win market share, secure profitability, increase company value, develop new products and services, and attract investors, top talent, and new customers. Companies that are excellent at ESG have a better awareness of business risks, take steps to mitigate them, and are more resilient to market uncertainty. These companies have the potential to create new business models and products, opening up opportunities to enter new markets. In November 2022, *Directive (EU) 2022/2464 of the European Parliament and of the Council of 14 December 2022 amending Regulation No 537/2014, Directive 2004/109/EC, Directive 2006/43/EC, and Directive 2013/34/EU, as regards corporate sustainability reporting*, also known as the Corporate Sustainability Reporting Directive (CSRD), was adopted by the European Parliament and the European Council. CSRD entered into force on January 6, 2023. EU member states have 18 months to transpose it into national law. The CSRD is considered a key component of the EU's sustainable finance action plan and the European Green Deal. It requires companies to report on their sustainability performance to provide investors and other stakeholders access to necessary information for assessing investment risks related to climate change and other sustainability factors and establish a transparent culture regarding a company's impact on society and the environment (Frikkee et al., 2023).

Furthermore, the European Commission has mandated the European Financial Reporting Advisory Group (EFRAG) to develop standards detailing what needs to be reported under CSRD. These standards are the European Sustainability Reporting Standards (ESRS). ESRS would be gradually applied for accounting periods beginning on/after January 1, 2024. The first companies reporting under ESRS would be the EU-large public-interest companies and non-EU companies with securities listed on a regulated market in the EU and having more than 500 employees. These are companies that already report under the NFRD. Reporting under CSRD and ESRS would further extend to other large companies, listed Small and Medium-sized Enterprises, non-EU parent companies, and small and non-complex institutions. The companies are required to present information on environmental, social, and governance matters in the sustainability report which should be prepared in a single electronic reporting format. Statutory auditors and audit firms are required to carry out the assurance of sustainability reporting in compliance with the assurance standards adopted by the Commission.

Currently, CSRD is being transposed into the Slovak accounting and auditing legislation with a likely effective date of June 1, 2024.

## 4. RESULTS OF THE QUESTIONNAIRE SURVEY

As part of our research, we investigated the importance that young people, university students, give to socially responsible businesses. We were interested in how they perceive sustainability and which attributes of sustainability they consider important in terms of the companies themselves. We carried out the questionnaire survey at five faculties of economic orientation and one law faculty, namely at the Faculty of Economic Informatics, University of Economics in Bratislava, Slovakia; at the Faculty of Economics, VSB – Technical University of Ostrava, Czech Republic; at the Faculty of Law, Palacký University Olomouc, Czech Republic; at the Faculty of Economics and Business, University of Maribor, Slovenia; at Institute of Economics, Finance, and Management, Jagiellonian University, in Krakow, Poland; at Department of Costing, Tax Management and Controlling, Wrocław University of Economics and Business, Poland. Altogether 296 respondents took part in the survey. The breakdown of respondents by country, age, and gender is shown in Table 1.

**Table 1:** Breakdown of respondents according to country, age, and gender

Country (Style: SM-Table)	Number of respondents	Age	Number of respondents	Gender	Number of respondents
Slovakia	132	Up to 25 years	273	Male	107
Czech Republic	100	More than 25 years	23	Female	189
Poland	39				
Slovenia	25				

Source: own processing based on survey.

Within the survey, we were interested if the respondents thought there exist some socially responsible companies in their countries. The results are shown in Table 2.

**Table 2:** Answers to question: In your opinion, are there socially responsible companies in your country?

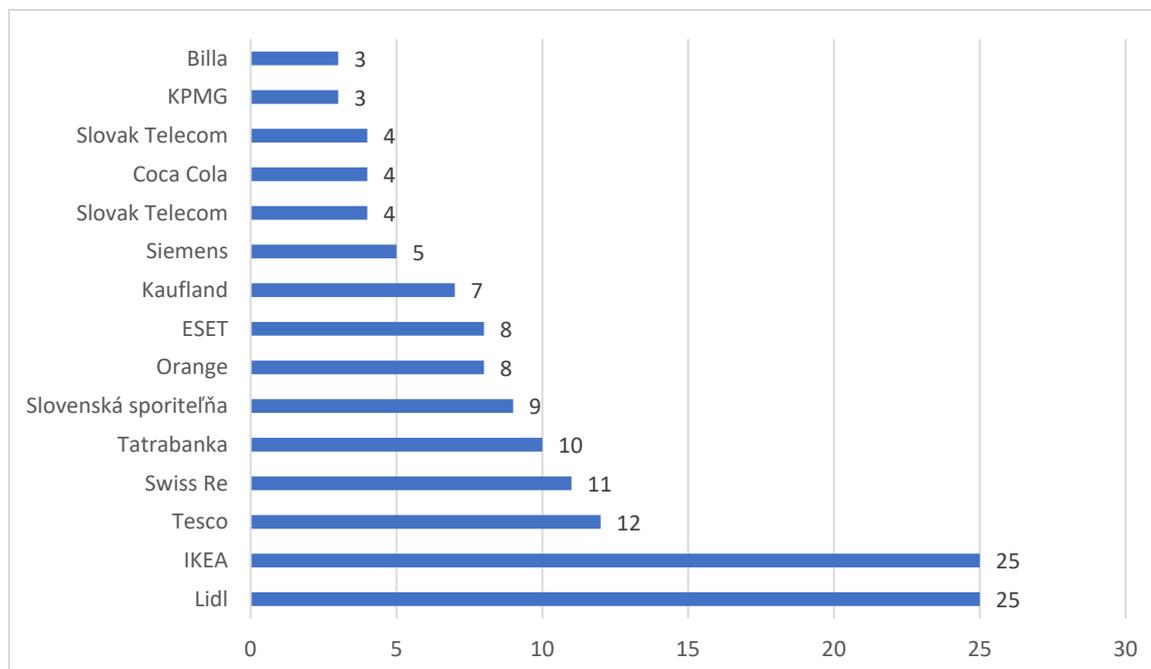
Country <i>*column percentages</i>	Slovakia	Czech Republic	Poland	Slovenia	Total
<b>Yes</b>	100 / 75.76%	60 / 60.00%	29 / 74.36%	17 / 68.00%	206 / 69.59%
<b>No</b>	3 / 2.27%	2 / 2.00%	2 / 5.13%	2 / 8.00%	9 / 3.04%
<b>I don't know</b>	29 / 21.97%	38 / 38.00%	8 / 20.51%	6 / 24.00%	81 / 27.37%
<b>Total</b>	132 / 100%	100 / 100%	39 / 100%	25 / 100%	296 / 100%

Source: own processing based on survey.

As we can see from Table 2, up to 69.59 % of the respondents admit that there are socially responsible companies in their country, and only 3.04% think that such companies do not exist in their countries. Up to 27.36% of the respondents do not know answer this question. Up to 75.76% of young Slovaks are convinced that there are companies in Slovakia that behave in a socially responsible way. On the contrary, only 60% of young Czechs are persuaded of this fact.

Although up to 75.76% of respondents from Slovakia stated that there are socially responsible companies in Slovakia, only 56 (56.00%) of them were able to name these companies. Among young Czech respondents are more positive results. Out of 60 respondents who admitted that there are socially responsible companies in their country, up to 42 of them (70.00%) were able to name some of these companies. In Poland, 23 respondents (79.31%) named some socially responsible companies, and in Slovenia only 9 respondents (52.94%) were able to name socially responsible companies. At this place, we have to point out that not every respondent was able to name 5 responsible companies. Five socially responsible companies were named by 30 respondents from Slovakia, 20 respondents from the Czech Republic, 12 respondents from Poland, and 3 respondents from Slovenia. Most respondents mentioned only one or two socially responsible companies.

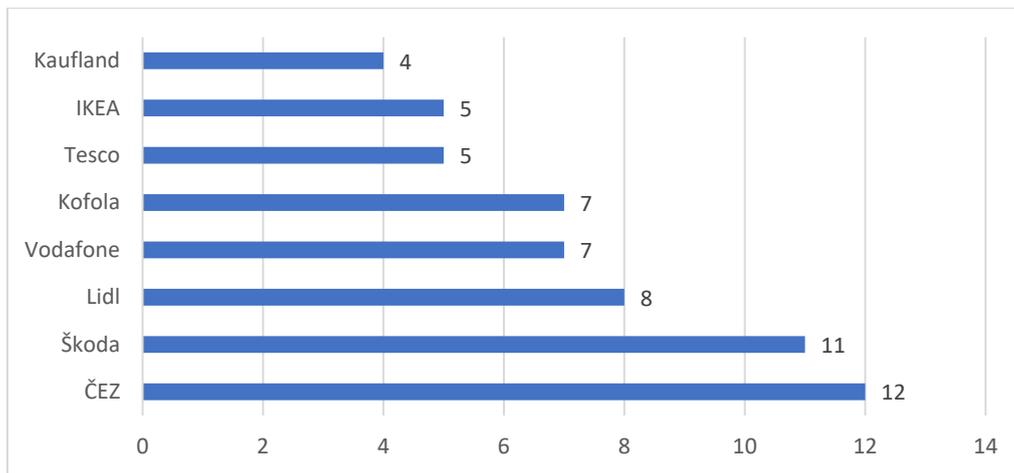
In Slovakia, the most mentioned companies (Figure 1) were Lidl (25 respondents), IKEA (25 respondents), and Tesco (12 respondents). Based on this, we can conclude that the younger generation perceives supermarkets, banks, and insurance companies, as well as mobile operators, as socially responsible companies. Other companies mentioned by respondents were Henkel, Metro, Slovenské elektrárne, dm drogerie markt, Softec, Uniqa, Kyndryl, Deloitte., Volkswagen, Anasoft, Bezobalovo, etc. Interestingly, even small local companies were mentioned by the respondents.



**Figure 1:** Socially responsible companies according to Slovak respondents

Source: own processing based on the survey

In the Czech Republic, the most mentioned companies (Figure 2) were ČEZ (12), Škoda (11), and Lidl (8). Other companies mentioned by respondents were Dermacol, Česká spořitelna, Deloitte, EY, Marlenka, Plzeňský Prazdroj, Vodafone, McDonalds, Innogy, Nestlé, Odragas, E.on, LG electronics, etc.



**Figure 2:** Socially responsible companies according to Czech respondents

**Source:** own processing based on the survey

The most mentioned companies by Slovenian respondents were KRKA, Gorenje, Impol, Lumar, Afrodita, Talum, Emmi, Hofer, etc. According to Polish respondents, the socially responsible companies are PGE, Orlen, CCC, Toyota, Google, PKP, Vans, Patagonia, Inglot, Roleski, Nestlé, Philip Morris, Danone, ABB, Biedronka, Tymbark, Starbucks, Colgate, Adidas, Nike, Mondy, etc.

Based on this, we can conclude that the younger generation in all four countries analyzed does not perceive only large multinational companies as socially responsible, as many small local companies were also mentioned among the aforementioned companies.

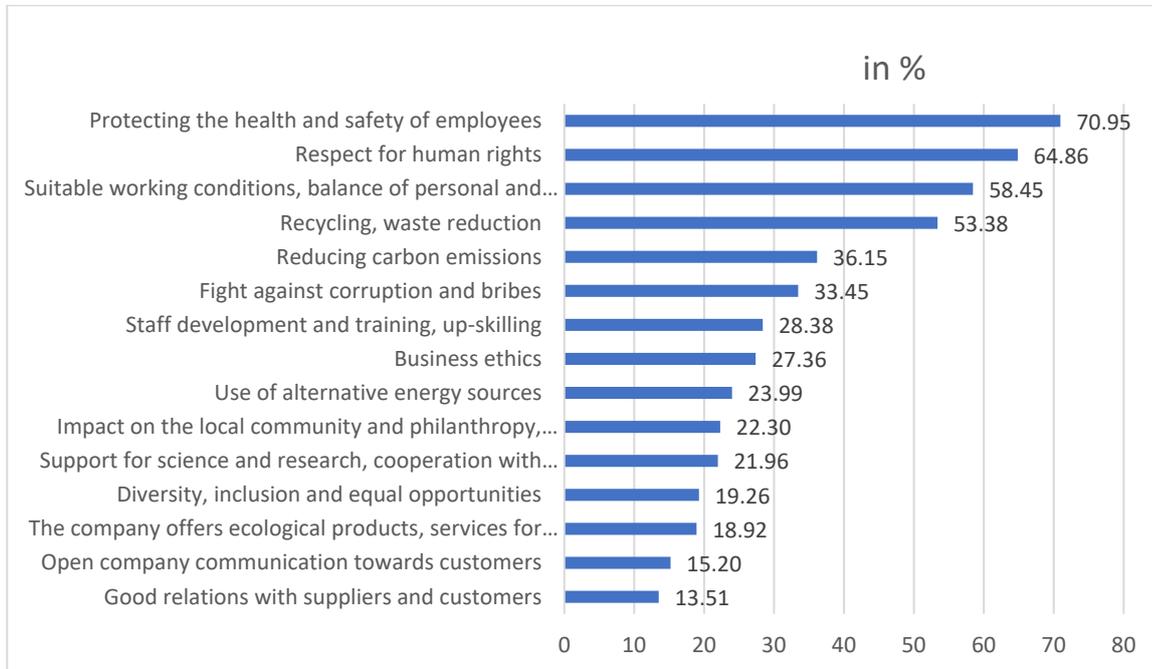
In the next question of the survey, the respondents were asked to select up to 5 attributes they consider to be the most important in the actions of responsible companies. They could select from these attributes:

- Protecting the health and safety of employees,
- Fight against corruption and bribes,
- Business ethics,
- Suitable working conditions, balance of personal and working time of employees,
- Diversity, inclusion, and equal opportunities,
- Respect for human rights,
- Impact on the local community and philanthropy, supporting the region where the company operates,
- Reducing carbon emissions,
- Use of alternative energy sources,
- Recycling, waste reduction,
- Open company communication towards customers,
- Staff development and training, up-skilling,
- Good relations with suppliers and customers,
- The company offers ecological products, and services for the socially or medically disadvantaged,
- Support for science and research, cooperation with schools.

In Slovakia, the most stated attributes were “Protecting the health and safety of employees” (75.7% of respondents), “Respect for human rights” (32.3%), and “Recycling, waste reduction” (22.00%). Czech respondents consider “Protecting the health and safety of employees” (75.00%), “Respect for human rights” (69.00%), and “Suitable working conditions, balance of personal and working time of employees” (59.00%) the most important attributes in the actions of socially responsible companies. In Poland, the most important attributes were “Respect for human rights” (66.7%), “Suitable working conditions, balance of personal and working time of employees” (61.5%), and “Protecting the health and safety of employees” (61.5%). Similar results to the previous three countries were also observed in Slovenia. The most important attributes of socially responsible behavior of companies were according to Slovenian respondents “Protecting the health and safety of employees” (84.00%), “Suitable working conditions, balance of personal and working time of employees” (72.00%), and “Respect for human rights” (56.00%).

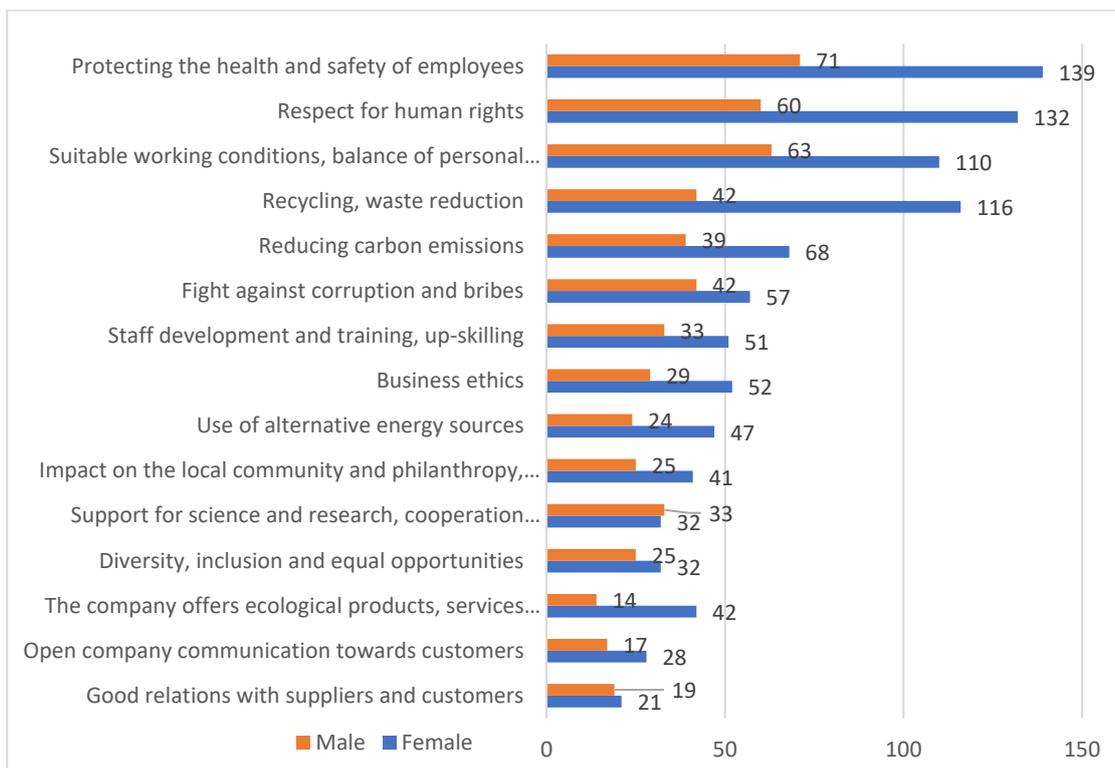
The least important attributes are (Figure 3) “Good relations with suppliers and customers” (13.51% of all respondents), “Open company communication towards customers” (15.20%), and the fact that “The company offers ecological products, services for the socially or medically disadvantaged” (18.92%). The Slovak respondents consider “Good relations with suppliers and customers” (11.36% of the Slovak respondents), “Diversity, inclusion, and equal opportunities” (18.18%), and “Open company communication towards customers” (18.94%) the least important attributes of CSR. Similar results were obtained by the Czech respondents who considered “Good relations with suppliers and customers” (11.00%), “Open company communication towards customers” (15.00%), and “Diversity, inclusion, and

equal opportunities” (16.00%) the least important attributes. In the case of Polish respondents, we observed slightly different results. According to them, the least sustainable attributes of companies are “Open company communication towards customers” (10.26%), “Good relations with suppliers and customers”, “The company offers ecological products, and services for the socially or medically disadvantaged” (17.95% each), and “Support for science and research, cooperation with schools” (20.51%). In Slovenia, the young respondents consider “Open company communication towards customers” (4.00%), “Support for science and research, cooperation with schools” (12.00%), “Use of alternative energy sources”, and “Diversity, inclusion, and equal opportunities” (16.00% each) the least important attributes of CSR. The overall results for all four countries are shown in Figure 3.



**Figure 3:** The most important attributes of socially responsible companies  
**Source:** own processing based on the survey

In the next part of our analysis, we focused on preferences for sustainable attributes of companies depending on gender. The results are presented in Figure 4.



**Figure 4:** The most important attributes of socially responsible companies according to gender

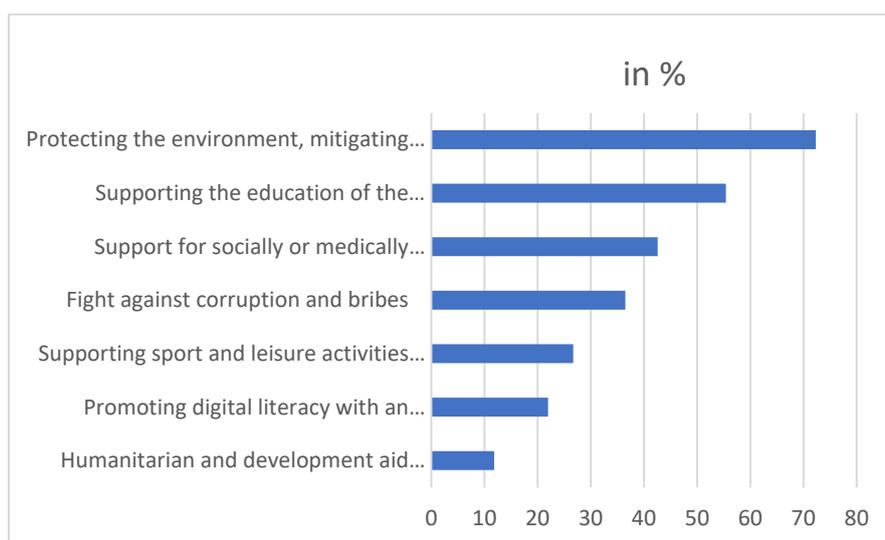
**Source:** own processing based on the survey

As we can see in Figure 4, the priorities are a little bit different between women and men, as well as in comparison with the overall results. Women consider “Protecting the health and safety of employees” (73.54% of female respondents), “Respect for human rights” (69.84%), and “Recycling, waste reduction” (61.38%) as the most important attributes of socially responsible behavior of companies. On the other hand, men prefer “Protecting the health and safety of employees” (66.36% of male respondents), “Suitable working conditions, the balance of personal and working time employees” (58.88%), and “Respect for human rights” (56.07%).

The next part of our survey focused on investigating which areas related to corporate social responsibility should companies prioritize their engagement in. The respondents should select up to three areas from the following:

- Support for socially or medically disadvantaged population groups,
- Protecting the environment, mitigating the impacts of climate change,
- Supporting the education of the younger generation,
- Supporting sport and leisure activities for children and young people,
- Fight against corruption and bribes,
- Promoting digital literacy with an emphasis on children and youth,
- Humanitarian and development aid abroad.

The results of the survey showed (Figure 5) that the young generation wants primarily companies to protect the environment and mitigate the impacts of climate change (72.30% of all respondents), to support the education of the younger generation (55.41%), and to support socially or medically disadvantaged population groups (42.57%). Similar results were obtained when examining respondents' views depending on their country of origin. Only in Poland, the second most preferable area of corporate responsibility was the “Fight against corruption and bribes”.



**Figure 5:** Areas related to CSR where companies should be the most engaged

**Source:** own processing based on the survey

Table 3 presents the results of the analysis of respondents' answers to the question of whether “they would prefer to buy a product or service from a company that behaves in a socially responsible way, even if they had to pay a little more”.

**Table 3:** Answers to the question: Would you prefer to buy a product or service from a company that behaves in a socially responsible way, even if you had to pay a little more?

Country <i>*column percentages</i>	Slovakia	Czech Republic	Poland	Slovenia	Total
Definitely yes	25 / 18.94%	13 / 13.00%	9 / 23.08%	8 / 32.00%	<b>55 / 18.59%</b>
Rather yes	80 / 60.61%	61 / 61.00%	23 / 58.97%	15 / 60.00%	<b>179 / 60.47%</b>
Rather no	12 / 9.09%	15 / 15.00%	2 / 5.13%	2 / 8.00%	<b>31 / 10.47%</b>
Definitely no	6 / 4.54 %	4 / 4.00%	0	0	<b>10 / 3.38%</b>
I don't know	9 / 6.82%	7 / 7.00%	5 / 12.82%	0	<b>21 / 7.09%</b>
<b>Total</b>	<b>132</b>	<b>100</b>	<b>39</b>	<b>25</b>	<b>296</b>

**Source:** own processing based on survey.

According to the results presented in Table 3, we can conclude that the younger generation in all countries analyzed would buy more expensive products or services from socially responsible companies. We consider this fact to be very positive.

“Yes” or “Rather yes” stated up to 79.06% of all respondents, namely up to 79.55% of respondents from Slovakia, 74.00% of respondents from the Czech Republic, 82.05% of respondents from Poland, and 92.00% of respondents from Slovenia. In the last question of the survey, we asked respondents whether they thought companies should report information regarding their socially responsible behavior (Table 4).

**Table 4:** Answers to the question: Should companies report information regarding their socially responsible behavior?

Country <i>*column percentages</i>	Slovakia	Czech Republic	Poland	Slovenia	Total
<b>Yes</b>	114 / 86.40%	85 / 85.00%	36 / 92.30%	23 / 92.00%	258 / 87.16%
<b>No</b>	5 / 3.80%	5 / 5.00%	1 / 2.60%	1 / 4.00%	12 / 4.06%
<b>I don't know</b>	13 / 9.80%	10 / 10.00%	2 / 5.10%	1 / 4.00%	26 / 8.78%
<b>Total</b>	132 / 100%	100 / 100%	39 / 100%	25 / 100%	296 / 100%

Source: own processing based on survey.

Up to 87.16% of respondents think that companies should present sustainability information. This information is important not only for their business partners, investors, and banks but also for customers, and the community in which the company operates. Information about how a company treats the environment and society, as well as what its management priorities are, builds a company's image and makes it competitive. By demonstrating its social commitment, responsibility, and sustainability in behavior, the company can gain the social recognition it needs to be successful.

## 4. CONCLUSION

ESG reporting will play still a more and more important role in the activities of companies. Sustainable business and reporting on environmental, social, and governance information are required not only by governments and public authorities to transform the European Union into a modern, resource-efficient, and competitive economy with no net emissions of greenhouse gases by 2020, to protect, conserve, and enhance the Unions natural capital and protect the health and well-being of Union citizens from environment-related risks and impacts, but are also required by investors, customers, employers, and other stakeholders. ESG reporting helps companies win market share, secure profitability, increase company value, and attract investors, new customers, and responsible employees. The sustainable business of companies can positively form the image of the company and make it more competitive in comparison with its competitors. It is expected that after transposing the CSRD into the national law of EU member states, the ESG reporting will be more transparent, comparable, and understandable, the presented information will be relevant, and verifiable, and will faithfully represent the impact of the company on the environment, society, and employees.

Our research proved that the younger generation perceives the socially responsible behavior of companies. Respondents from all four countries were able to name companies that behave responsibly to the environment and society.

According to our research, “Protecting the health and safety of employees”, Respect for human rights”, “Suitable working conditions, the balance of personal and working time of employees”, and “Recycling, waste reduction” belong to attributes which more than 50.00% of respondents consider to be the most important in sustainable behavior of companies. The results showed that the younger generation prefers social aspects of CSR related to employees over those related to the company's behavior towards business partners or customers.

The results of the questionnaire confirmed that more than 50.00% of the younger respondents think that companies should be more involved in “Protecting the environment, mitigating the impacts of climate change” and “Supporting the education of the younger generation”. We positively assess the fact that the younger generation (79.06% of all respondents) is willing to pay extra for products or services offered by a socially responsible company that focuses on protecting the environment and establishing suitable working conditions for its employees. Up to 87.16% of all respondents approved that companies should report sustainability information. Companies are required to report not only on financial but also on their social and environmental performance. By applying CSRD and ESRS, companies are expected to not only report sustainable information but also to truly act responsibly towards the environment, employees, the community, and society.

## ACKNOWLEDGMENTS

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**Marijana Petrović**

Academy of technical and art applied studies  
 Belgrade, Serbia  
 e-mail: marijana.petrovic@ict.edu.rs

## IT CONSUMERIZATION – A SYSTEMATIC MAPPING STUDY

**Abstract:** The utilization of personal IT devices for business purposes, either alongside or instead of official IT infrastructure, is called IT consumerization. This trend is driven by consumers' desire to choose the technology for work based on their own preferences and requirements. Its ubiquity in recent years has brought into focus the importance of understanding this phenomenon, both for researchers and decision makers. Thus, this study aims to systematically gather, organize, and synthesize existing scientific literature on IT consumerization, aligning with the research problem that entails identifying the current state, trends, and gaps in the academic literature. The research methodology is grounded in systematic mapping and categorization of literature by publication year, source, nature, publication type, and classification of relevant works according to research topics. The findings will offer an overview of key references and themes, facilitating a deeper insight into key aspects of this phenomenon, while also pinpointing knowledge gaps to lay the groundwork and provide direction for future research.

**Keywords:** IT consumerization, systematic mapping study

### 1. INTRODUCTION

Consumerization of IT (CoIT) is the trend of using personal technology, i.e. devices (most often smartphones, laptops, tablets) and applications (for productivity, collaboration, file sharing, etc.) for performing business tasks. This trend has emerged due to several technological and market factors, including the miniaturization of electronics, the increased power and decreased prices of computers, the availability of affordable internet services, the rise of ubiquitous computing, smartphones, web 2.0, etc. These factors have collectively influenced today's technology users through personal IT devices. The rapid development and focus of personal devices manufacturers on an intuitive, enjoyable, and personalized technology experiences have not only shaped users' technical skills and knowledge but also their expectations of technology when entering a workforce. However, the advancement of business technology has not kept pace with personal technology, which has resulted in the unfulfilled expectations of users, who turn to their own IT devices from an outdated, underperforming, and unintuitive business systems to expedite and simplify their work processes (Petrović & Sakal, 2024). In recent years, this trend has become more frequent among employees (Burleson, Grover, Thatcher, & Sun, 2021). Experts foresee its ongoing impact on the future of work (Rudly, 2022), underscoring the significance of addressing this subject. Consequently, this paper aims to address the research problem of identifying the current state, trends, and gaps in the scientific literature regarding IT consumerization.

The objective of this paper is to systematically gather, organize, and summarize existing scientific literature on IT consumerization, aligning with the established research problem. This approach will help delineate trends and future research directions through a systematic mapping study. An examination of the current state enables researchers to identify previously explored topics and areas necessitating further attention and analysis, while forecasting trends and research directions aids in anticipating changes, challenges, opportunities, and formulating appropriate responses. The subsequent sections of the paper will delve into the research design and methodology, following the stages of the mapping study process, followed by a discussion, limitations and future research directions.

## 2. SYSTEMATIC MAPPING STUDY

A systematic mapping study (SMS) is a form of a systematic literature review (SLR) (Kitchenham, Budgen, & Brereton, 2011) that is primarily focused on structuring a particular thematic area of research. It involves the identification of available research in the literature, their analysis and categorization, in order to offer a comprehensive overview of a particular research topic (Salama, Bahsoon, & Bencomo, 2017). The organized summary of knowledge resulting from SMS can lay the foundations for further research (García-Mireles, Moraga, García, Calero, & Piattini, 2017) and future SLR (Petersen, Vakkalanka, & Ludwik, 2015), as it identifies which categories are well covered in terms of the number of publications and indicates to a research gap (Petersen, Feldt, Mujtaba, & Mattsson, 2008). The methodology includes a thorough search of selected sources, extraction of key information, analysis of identified topics, and development of a clear overview of current knowledge on a specific topic through stages such as: planning, execution of SMS, and reporting of results (Petersen, Vakkalanka, & Ludwik, 2015).

### 2.1. Planning

The first step of the planning phase is defining the research questions (Salama, Bahsoon, & Bencomo, 2017). Unlike SLR, which typically pose highly specific research questions, in SMS questions are general and broad in order to achieve the objective of categorizing topics covered in the literature and uncovering research trends. An example of a question suitable for an SMS study is: "What do we know about a certain topic?" (Petersen, Vakkalanka, & Ludwik, 2015). Accordingly, the following research questions were formulated within the framework of this paper:

- RQ1: "What are the prevailing trends and studied areas within the domain of CoIT and how can they be categorized?"
- RQ2: "Which areas require more research?"

Within the first research question, sub-questions can be asked that will help in finding answers, such as:

- RQ1a: "What are the trends in the frequency of publication of papers by year, place of publication (journal/conference paper) and the nature of the research (theoretical/empirical)?"
- RQ1b: "What are the research types (methodologies and approaches) of the identified studies?"
- RQ1c: "What is the focus of the study, i.e. research context?"

Sub-questions 1a and 1b will provide a comprehensive overview of the methodological landscape, while the importance of sub-question 1c is reflected in enabling a clear categorization, as the context of the study will facilitate the identification of key themes for the categorization of papers, as well as their comparison in different conditions and settings.

In the second step of the planning phase, the research scope was defined to encompass all papers pertinent to the topic area (Salama, Bahsoon, & Bencomo, 2017). As the term CoIT was defined in 2004 in a position paper (Moschella, Neal, Opperman, & Taylor, 2004), that year was taken as the initial limit of the time frame. Then, in the third step, the research strategy was formulated, encompassing the selection of sources and keyword strings to search for studies across electronic libraries and indexing systems (Salama, Bahsoon, & Bencomo, 2017). As part of the strategy, it was defined that the KOBSON portal (Service of the Consortium of Serbian Libraries for Unified Procurement) will be used to search for studies, a platform that facilitates access to a number of subscribed electronic resources. It provides multidisciplinary content, the ability to connect users to various academic databases and platforms that host electronic resources, as well as access to a wide range of academic journals, conference proceedings and electronic books (<https://kobson.nb.rs>). The identification of keywords was based on the term CoIT. Therefore, the strings used in the search were: "IT consumerization" or "Consumerization of IT". A paper was considered a candidate for SMS if it explicitly mentioned CoIT or one of its forms (Shadow IT - SIT, Bring Your Own Device - BYOD). Because the area of interest is focused only on research trends, the search requirements were less stringent (Petersen, Vakkalanka, & Ludwik, 2015).

In the fourth step of the planning phase, the criteria for the selection of relevant studies, i.e., the inclusion/exclusion of papers, were defined. This SMS included empirical and non-empirical studies published in scientific journals and conferences (García-Mireles, Moraga, García, Calero, & Piattini, 2017). The criteria for inclusion/exclusion of papers were based on limitations in terms of language, place of publication, time period, relevance of the topic of the article and its availability. Inclusion criteria included:

- Papers written in English;
- Peer-reviewed papers published in a journal or at a conference;
- Papers from the time period from 2004 to 2024;
- Papers dealing with the topic of CoIT;
- Papers with full-text available through chosen databases/aggregators;

Accordingly, the exclusion criteria were:

- If the paper is not written in English;
- Books and gray literature;
- If the paper does not deal with the topic of CoIT;
- If the paper is a duplicate of another study;
- If the full text of the work is not available.

## 2.2. Execution of SMS

The SMS implementation phase consists of the following sub-phases: source search, study selection, data extraction and categorization, and their analysis and mapping.

The search was conducted in the sources defined by the strategy according to keywords. For the automated search of publications within the KOBSON portal, the following sources were employed: indexed databases such as Web of Science and SCOPUS, aggregators including EBSCO, DOAJ (Directory of Open Access Journals) and publishers like Emerald Group Publishing, Wiley online library, SAGE Journals and Springer Link. The date of access to papers on KOBSON is 01.01.2024. year, which is also the upper time limit of the scope of the study. The search string was tested in the Web of Science database, after which it was applied to other databases/aggregators/publishers. Search results showing hits by key words are given in Table 1.

**Table 1: Results of the automated search**

<b>Keywords: ("IT consumerization") OR ("Consumerization of IT")</b>		
<b>Bibliographic databases, aggregators and publishers</b>	<b>Provider</b>	<b>Number of hits by title and abstract</b>
Web of Science	Thomson Reuters	63
Scopus	Elsevier	115
EBSCO Academic Source Premier + EBSCO Business Source Premier	EBSCO publishing	122
DOAJ		7
Emerald Group Publishing	Emerald Group Publishing	54
Wiley	Wiley	69
SAGE Journals		13
Springer Link	Springer	77

Source: Author, 2024.

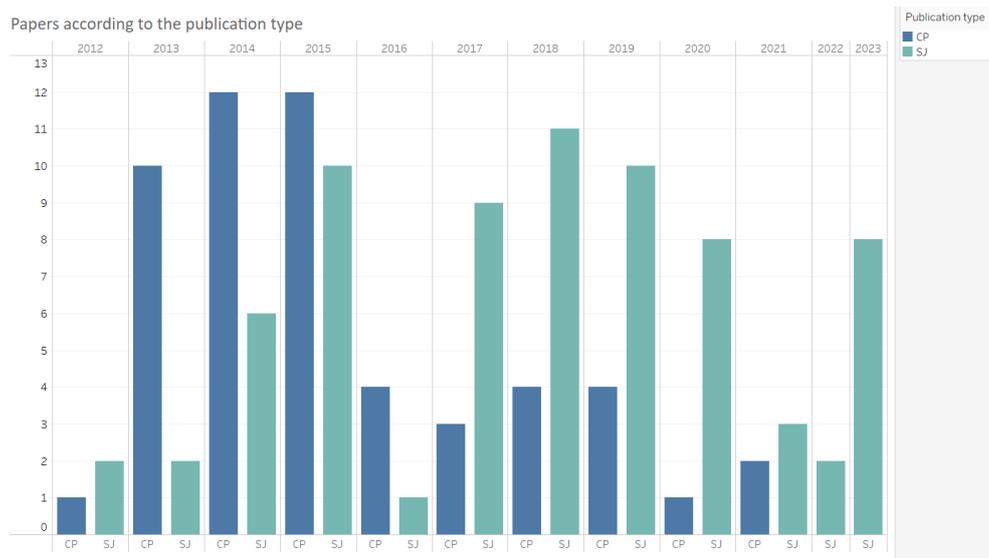
Primary studies were identified through manual searching conducted in two stages. In the first stage of the identification process, the title, key words and abstract were read with the application of the inclusion/exclusion criteria in order to determine the relevance of the paper. In the second phase, for studies that couldn't be initially included in the SMS corpus based on the first phase, the complete text of each paper was thoroughly examined, applying the selection criteria. Secondary studies (literature reviews, taxonomies) were also taken into account. The quality of papers was not evaluated, because according to (Kitchenham, Budgen, & Brereton, 2011) it is not a necessary step for the SMS study. Study selection resulted in a list of 125 relevant papers, after removing duplicates.

In the subsequent phase of the SMS study, each extracted paper was reviewed to identify keywords and concepts in order to categorize the papers (Salama, Bahsoon, & Bencomo, 2017). For the purpose of categorization, factors such as the covered topic, location, nature, and type of research were taken into account. These factors align with the criteria outlined by (Kitchenham, Budgen, & Brereton, 2011), which typically serve as the basis for defining categories in publications. Extracted keywords served as the means for establishing a categorization framework within MS Excel, wherein the author manually crafted custom category ranges („Data classification methods“, n.d.). Subsequently, the articles were sorted according to their respective categories, and their distribution was visually depicted through graphical representation (Petersen, Vakkalanka, & Ludwik, 2015).

After extracting and categorizing the studies, the acquired findings underwent analysis. Following this a systematic mapping was created (Salama, Bahsoon, & Bencomo, 2017) which was elaborated in the subsequent chapter.

## 2.3. Reporting of results

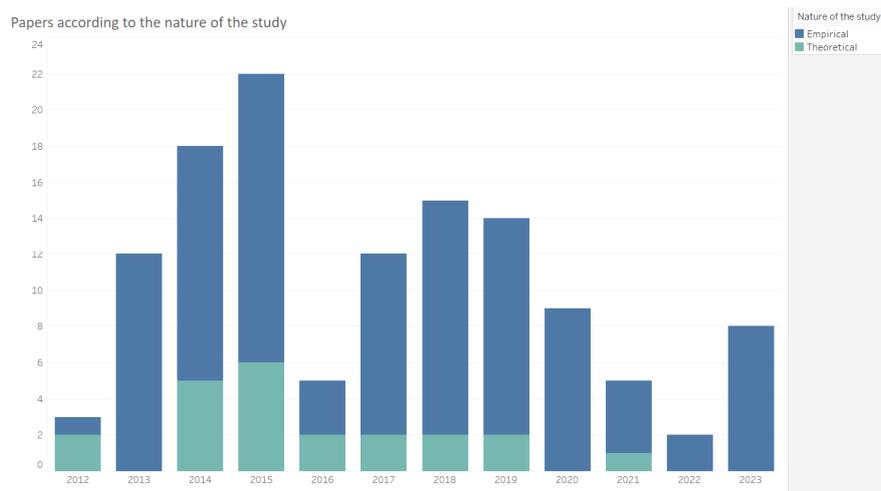
In response to RQ1a, the trends in the frequency of publication of papers by year and place of publication are illustrated in Figure 1.



**Figure 1. Papers according to year and place of publication**  
Source: Author, 2024

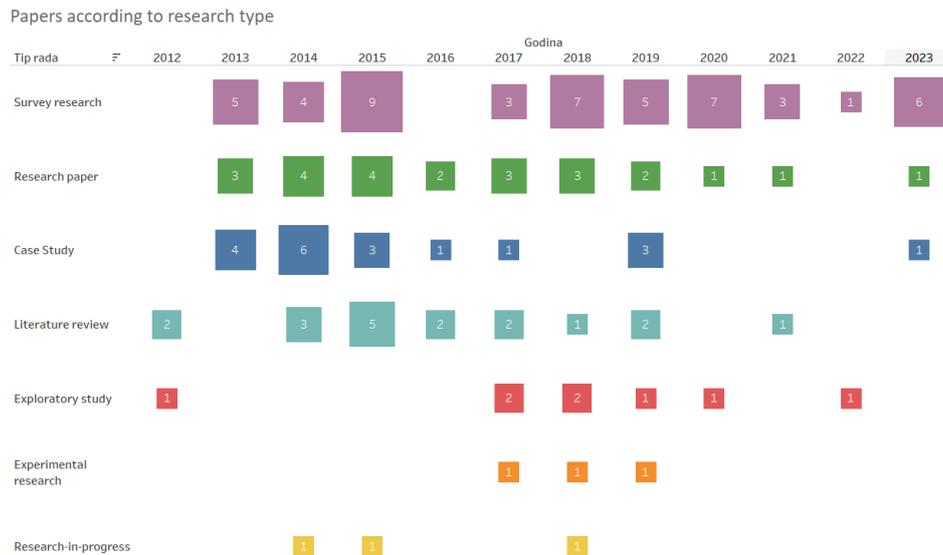
Of the total number of papers, 58% were published in scientific journals (SJ), and 42% at conferences and conference proceedings (CP). There is a noticeable downward trend of papers from conferences from 2015 to 2021, so that in the previous two years no conference papers appeared in the researched databases at all. On the other hand, the representation of scientific journals varies from year to year, but the number of these papers increased from only two in 2022 to nine in 2023.

The following graph illustrates the representation of papers categorized according to the nature of the study.



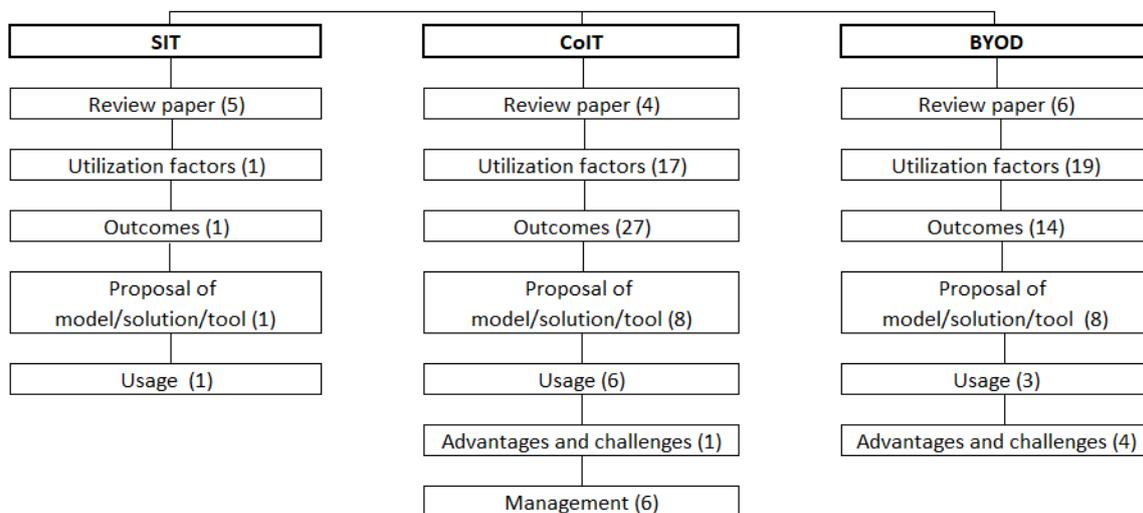
**Figure 2. Papers according to the nature of the study**  
Source: Author, 2024

Only 18% of papers are theoretical, and their distribution over the years indicates a downward trend. The following graph shows the representation of various types of papers by year.



**Figure 3. Types of papers by year**  
Source: Author, 2024

In response to research question 1b, the most represented types of studies were identified in the extracted corpus, namely: survey research (40%), research papers (19%), case studies (15%) and literature reviews (15%). Trend indicates that over the last three years, there has been a predominance of surveys, research papers, and literature reviews, while other types of studies are either minimally represented or not represented at all. The categorization according to the covered topic, subtopics and the corresponding number of papers addressing those subtopics is presented in Figure 4, answering research question 1c.



**Figure 4. Themes and subthemes identified in the literature**  
Source: Author, 2024

The literature highlights three main themes: SIT (IT consumerization that is done clandestinely, without the knowledge of the employer), CoIT and BYOD (IT consumerization that is done with control and rules of use set by the employer). Papers studying SIT represent the lowest proportion (about 6%), publications addressing the BYOD phenomenon are significantly more numerous (42%), while the most abundant group comprises sources focusing on CoIT (52%). Observing the focus of the study in accordance with research question 1c, the following subthemes are distinguished: review papers, papers dealing with the factors of using personal devices for business purposes, their outcomes, the use and proposal of specific models/solutions/tools for the use of CoIT, advantages, challenges and management. The largest number of papers (almost 60%) deals with outcomes and factors of use. Looking at the contexts of those papers, 28% of them is dealing with a specific context, such as: healthcare (8 papers), education (6 papers), public sector (5 papers), certain industries such as energy, financial organizations, libraries etc. (9 papers), the context of small and medium-sized enterprises (4 papers) or knowledge workers (3 papers)), Additionally, specific types of CoIT are

addressed, including smartphone usage (7 papers), cloud (2 papers), mobile applications (1 paper), mobile application stores (1 paper), social media (1 paper), Mobile Device Management system (1 paper), file sharing context (1 paper). Furthermore a particular group of respondents is studied, including students, students with work experience and elementary school students (13 papers), managers (4 jobs), Chief Information Officer (CIO) (2 jobs), IT departments (2 jobs) and employees in the aforementioned mentioned specific industry branches.

Within the sub-theme "Factors of use", only 38% of papers deal with non-specific context/elements/respondents, and this is a potential research gap. In the case of the "Outcomes" sub-theme, 59% of papers covered the wider context of the consequences and positive impacts of CoIT. The "Model/Solution/Tool Proposals" mostly deal with employee security and control issues and this area seems to be well covered. The subtopic "Usage of CoIT" has only 1 out of 9 papers that is not in a specific context of use, which is understandable given that the use of personal devices/applications can only be described and investigated in the context in which it occurs. The sub-topic "Advantages and challenges" has been fully addressed only for specific contexts (education, libraries, health, SMEs, knowledge workers), so there is an opportunity to investigate it within a broader context.

### 3. DISCUSSION

This paper provides a comprehensive summary of current information sourced from scientific and professional outlets concerning the topic of CoIT, serving as the foundation for further research - a systematic literature review. The findings reveal a shift in publication trends with an increasing proportion of papers appearing in scientific journals compared to conference papers, particularly notable in recent years where no conference papers were found in the surveyed scientific databases. Empirical studies constitute over 80% of the literature, showing a rising trajectory. Predominantly, the works comprise surveys, research papers, case studies, and literature reviews.

The themes that emerged from the extracted literature can be categorized into different types of CoIT (CoIT, SIT and BYOD) encompassing aspects such as CoIT usage, influencing factors, outcomes, management, advantages, and challenges. A large number of papers delve into specific contexts, elements and respondents, especially within empirical studies. Notably, a research gap is identified regarding the broader context of benefits and challenges, as well as the factors influencing CoIT usage.

Among papers examining usage factors with non-specific context/elements/respondents, a significant portion focuses on acceptance of company restrictions on personal device use, rather than exploring driving factors of CoIT adoption, indicating an under-researched area. Moreover, while security management is extensively covered in the literature, there is a dearth of works addressing CoIT management within the context of risk and opportunity optimization, presenting a potential avenue for future research.

### 4. LIMITATIONS AND FUTURE RESEARCH

This study potentially faces a bias concern, as the search process, data extraction, and categorization were performed by a single researcher, creating a categorization scheme of themes and subthemes manually using custom range of categories that she defined (Salama, Bahsoon, & Bencomo, 2017). Although (García-Mireles, Moraga, García, Calero, & Piattini, 2017) suggest that the process of searching papers need not be exhaustive, but rather subject to revision, questions may arise regarding the study's coverage. A limitation of the search process in this paper may be that only the KOBSON portal was searched, although the author believes that a significant portion of relevant papers on the topic has been covered. Additionally, only a certain set of criteria was employed in this study, with the aim of creating a basic mapping according to year, place, nature, type and context of research (Salama, Bahsoon, & Bencomo, 2017), serving as a foundation for a systematic literature review.

Future research will prioritize the investigation of identified research gaps, with a particular focus on understanding the drivers behind CoIT adoption, exploring the benefits and challenges associated with CoIT implementation, and developing effective strategies for CoIT management. Among the driving factors, a more detailed examination could delve into technological, organizational, sociocultural, economic and other factors that encourage users to utilize their personal IT devices for business purposes. Regarding the advantages and challenges framework, a deeper analysis could be conducted on the positive and negative impacts of CoIT on employees, including its effects on productivity, flexibility, satisfaction, security, privacy, and related aspects. Additionally, the less-explored realm of managing IT consumerization could be further investigated by examining the policies and techniques utilized by organizations to mitigate potential risks and leverage opportunities of IT consumerization.

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**Dejan Zdraveski**  
 Faculty of economics  
 Prilep, Republic of North Macedonia  
 dejan.zdraveski@uklo.edu.mk

**Gjorgji Manceski**  
 Faculty of economics  
 Prilep, Republic of North Macedonia  
 gmanceski@t-home.mk

**Kosta Sotiroski**  
 Faculty of economics  
 Prilep, Republic of North Macedonia  
 kosta.sotiroski@uklo.edu.mk

**Petar Avramovski**  
 UKLO Network  
 Bitola, Republic of North Macedonia  
 avrmovski@gmail.com

**Margarita Janeska**  
 Faculty of economics  
 Prilep, Republic of North Macedonia  
 margarita.janeska@uklo.edu.mk

## THE USE OF CLOUD COMPUTING IN HIGHER EDUCATION IN REPUBLIC OF NORTH MACEDONIA

**Abstract:** The development of information technologies has enabled higher education institutions to improve their teaching and learning methods through the use of modern IT platforms and tools and thus completely change the environment for the implementation of the teaching and learning process. Cloud computing as a model of offering information resources has enabled universities to use IT resources efficiently. Through the implementation of Cloud computing model in teaching process, every university can afford the use of relatively large amounts of information resources with relatively low costs for their use. It is especially important for developing countries such as the Republic of North Macedonia, which are not able to allocate large financial resources for the purchase of the latest expensive information technologies. Today, Cloud computing platforms for education (Google Suite for education, Microsoft education, Amazon cloud computing for education, Coursera, Blackboard, Evernote etc.) through the benefits they offer such as the availability of applications, cost effectiveness, flexibility, ease of use and security, enable universities to transform traditional learning processes and thereby advance the overall higher education process.

The main goal of this paper will be to present the level of use of Cloud computing platforms and tools in higher education institutions in the Republic of North Macedonia. For this purpose, a questionnaire was created in which the largest number of universities in the Republic of North Macedonia were included. This paper will present a qualitative and quantitative analysis of the results obtained from the survey. The questionnaire was created using Google forms and was delivered to the academic staff from the most of universities in Republic of North Macedonia. Also, through this paper, most of the challenges and benefits of using Cloud computing platforms/tools will be presented.

Key words: cloud computing, information technology, education, benefits, challenges, teaching

### 1. INTRODUCTION

Information and communication technologies have completely changed the way of life and exponentially helped the progress of the entire human civilization in the last few decades. These technologies have gradually penetrated into all segments of society, enabling the automation and digitalization of large number of processes. Like other areas in society, higher education has not remained immune to the changes that are happening today and are the result of the explosive development of information technologies.

Higher education is one of the most important segments in the functioning of any society. At the same time, the main goal of every higher education institution is the realization of a quality teaching and learning process for its students, who would be competitive on the labor market after graduation. Quality improvement of teaching and learning process in recent years is possible by the emergence of new technologies that provide unlimited opportunities to students and professors. The development of new information technologies enables the transformation of higher education and the improvement and advancement of teaching and learning methods. One of the models based on advanced information technologies is the Cloud computing model. The formal definition of cloud computing comes from the National Institute of Standards and Technology (NIST): "Cloud computing is a model for enabling ubiquitous, convenient, on-

demand network access to a shared pool of configurable computing resources (e.g., networks, servers, storage, applications, and services) that can be rapidly provisioned and released with minimal management effort or service provider interaction. This cloud model is composed of five essential characteristics, three service models, and four deployment models (K. Chandrasekaran, 2015). The three basic service models are Infrastructure as a Service (IaaS), Platform as a Service (PaaS) and Software as a Service (SaaS), while the four deployment models are Public Cloud Computing, Private Cloud Computing, Hybrid Cloud Computing and Community Cloud Computing. The Cloud computing sees no borders and thus has made the world a much smaller place (Rittinghouse J.W., Ransome J.F., 2010). Today, with the application of the Cloud computing model, especially universities from developing countries can have access to a large amount of information resources. This is particularly significant for these countries because they face a number of limitations, primarily financial constraints, because the purchase of new information technologies is relatively expensive. Using Cloud Computing model, universities can have access to large amounts of information resources for relatively low prices. By using some Public Cloud services (e.g., Gmail) some of these informational resources can be obtained completely free of charge. Cloud Computing is the third revolution after PC and Internet in IT. Specifically, Cloud Computing is the improvement of Distributed Computing, Parallel Computing, Grid Computing and Distributed Databases (Khadiga M. and all 2018). With its five essential characteristics such as On-demand Self-service, Resource pooling, Measured services, Flexibility and Rapid elasticity, Cloud computing provides Higher education institutions numerous benefits.

## **2. CLOUD COMPUTING AND HIGHER EDUCATION**

Today, the most of universities are beginning to use the benefits of new information technologies. Many universities in the world recognize the potential and efficiency offered by the Cloud computing concept, so they strive to implement this concept in the teaching process. The benefits offered by the application of cloud computing can be numerous, such as: access to a large number of applications without geographical and time barriers, new and modern ways of implementing curricula, easy communication and interaction between participants in the teaching process, low costs for using the software, greater availability of learning resources etc. Already, Cloud service providers have established platforms such as Google Suite for education, Microsoft education, Amazon Cloud for education, etc. which enable support of the teaching and learning process. Cloud computing providers such as Google and Microsoft through their learning platforms provide educational institutions with a whole range of services for the realization of their teaching and learning process. These services include the use of e-mail, calendars, document storage, contact lists, on-line lectures and meetings, creation of quizzes and tests, classrooms for each group of students, etc.

In that context, the universities in the Republic of North Macedonia must adapt to the modern trends in the world. The importance of new information technologies and models came to the fore especially during the pandemic, when the conditions and ways of implementing the teaching process completely changed. In that period, Cloud platforms and tools were the basic ways of implementing the teaching process and proved to be a successful form for the implementation of curricula. After the end of the pandemic, some universities continued to use a Cloud platforms and tools as primary or additional tools of teaching.

In this paper, we explore the use of Cloud platforms/tools in higher education, as well as the challenges and benefits of using these tools. In addition, the emphasis will be on several issues related to: application of Cloud tools in each cycle of studies, dynamics of application using, the ways of teaching, the future of Cloud computing in Higher Education, etc. This paper will be a pioneering step in researching the application of Cloud computing platforms/tools in higher education in the Republic of North Macedonia, because so far there are no data in this area at all. We hope that this paper will be a good basis for further research on the application of Cloud Computing not only in higher education but also in primary and secondary education.

## **3. USE OF CLOUD COMPUTING IN HIGHER EDUCATION INSTITUTION IN REPUBLIC OF NORTH MACEDONIA-EMPIRICAL RESEARCH**

To explore use of Cloud computing in higher education institution in Republic of North Macedonia was used the method of representative sample and were used combined questions of different types. The data obtained through an on-line questionnaire contained closed-ended questions and was used Likert scale for certain specific questions. The questionnaire created with Google Forms was sent via e-mail to the academic staff of Macedonian universities. In addition, 115 respondents answered questionnaire, which is an appropriate and representative sample based on which relevant conclusions can be drawn. In this paper will explore use of Cloud computing in higher education institutions in Republic of North Macedonia in realization of the curricula.

The questionnaire was sent to academic staff from 19 universities in the Republic of North Macedonia, from which answers were collected from 12 universities that are best ranked on several lists such as Webometrics and Edurank. At the same time, the largest part of the respondents were from the two oldest and the biggest universities, the University "St. Cyril and Methodius"- Skopje and University "St. Kliment Ohridski"- Bitola, which can be seen from the following Figure.

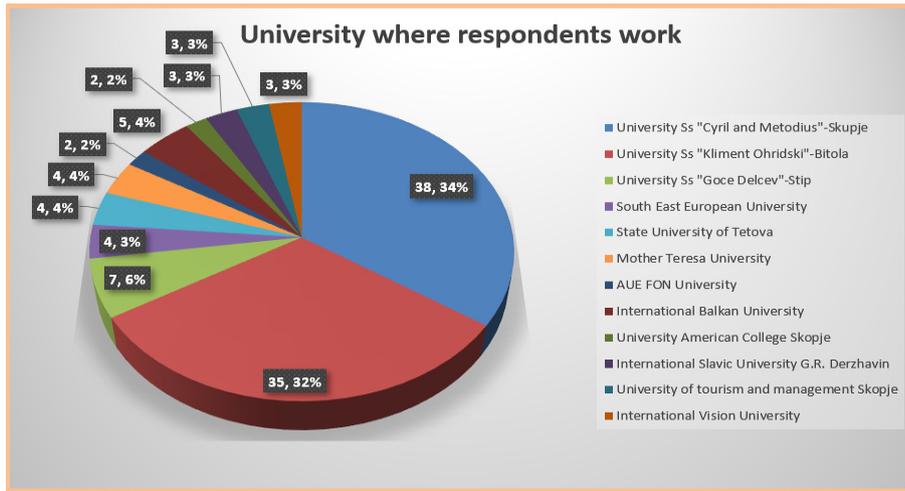


Figure 1. University where respondents work

The first group of questions refers to the personal characteristics of the respondents such as age, gender, work experience, academic title, etc. All those parameters can be viewed in the following Figure.

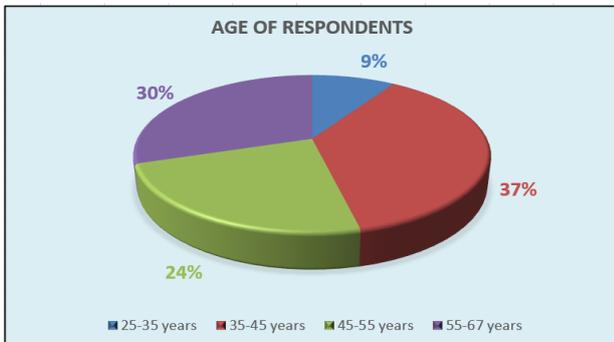


Figure 2. Age of respondents

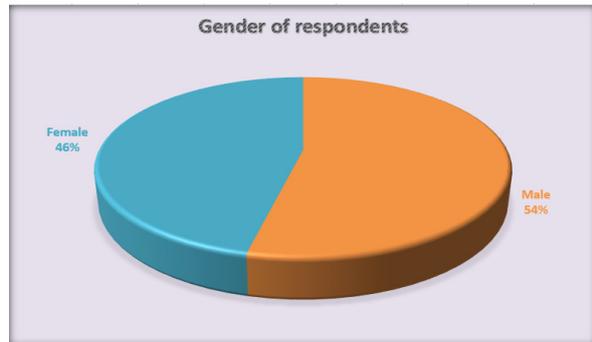


Figure 3. Gender of respondents

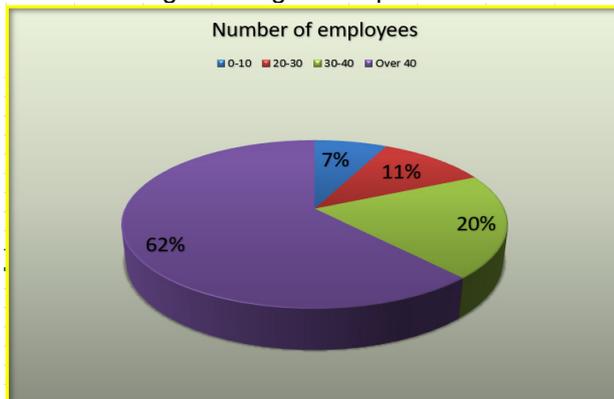


Figure 4. Number of employees in institution

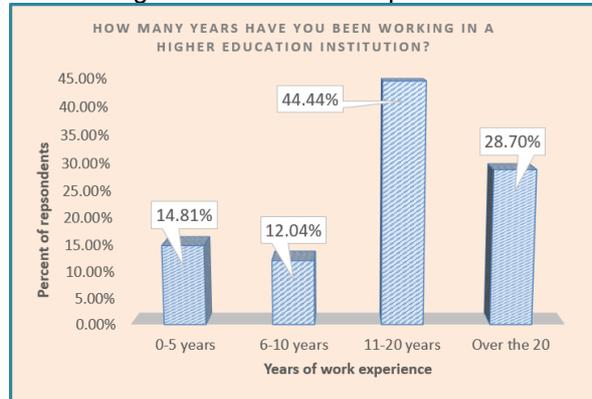


Figure 5. Working experience of respondents

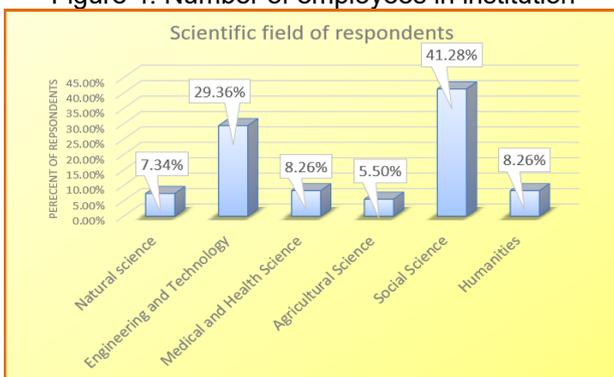


Figure 6. Scientific field of respondents

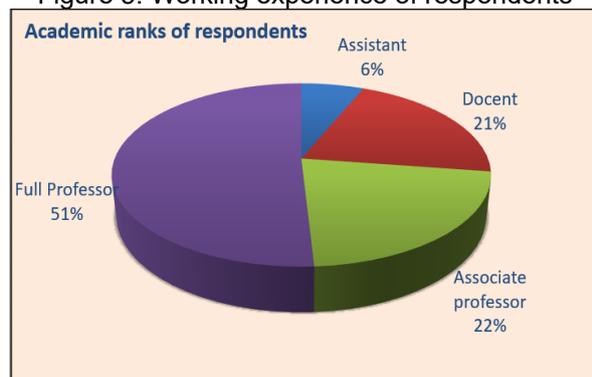


Figure 7 Academic rank of respondents

As can be seen from the Figure 2, academic staff from all age groups are relatively equally represented, and the least number of them are in the age of 25-35 years, or only 9%. It is one of the biggest problems in higher education in the Republic of North Macedonia, and that is the lack of young academic staff. The reasons for this are various, starting from the insufficient investment of the state in higher education to the low interest of young people for academic career due to the low salaries in higher education. Also, in this context the results from Figure 7 corresponds with this issue and according to these results about academic rank of the respondents, the largest part of them are full professors (51%), then associate professors (22%), assistant professors (21%) and only 6% are assistants.

Most of the respondents are from institutions with over 40 employees or 62%, while most of the respondents have work experience of 11-20 years or 44.44%.

When it comes to the scientific field in which the respondents work, academic staff from all scientific fields are represented, of which the majority of respondents are from social sciences or 41.28% and Engineering and technology with 29.36%.

Today, it is almost unbelievable to realize a large number of processes without the application of new advanced technologies. It is same situation in the processes of education. The development of information technologies contributed to their increasing application in the educational process, which led to the modernization of the teaching and learning process. That fact is confirmed by the results obtained with this research. A very small or insignificant part of the respondents, i.e. only 2%, apply a traditional way of teaching without the use of information technology. The largest part of the academic staff applies a form of teaching with the support of information technology (57% of respondents), while a part of the respondents (11% of respondents) implement the curriculum exclusively based on information technologies. All this confirms the fact of the increasing implementation of information technologies in the teaching and learning process.

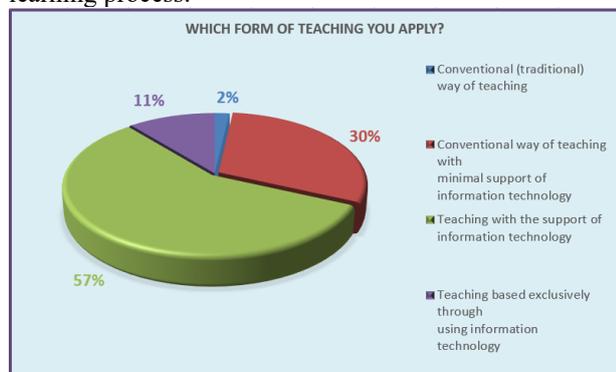


Figure 8. Form of teaching

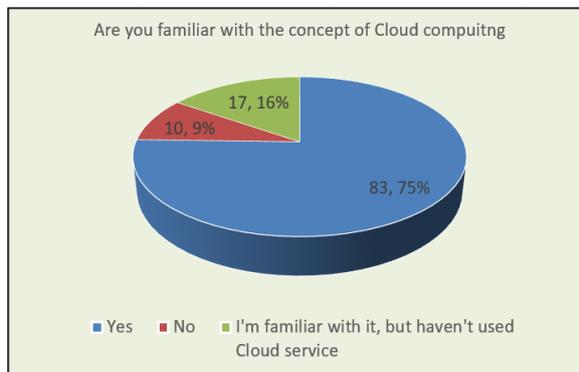


Figure 9. Familiarity of respondents with Cloud computing

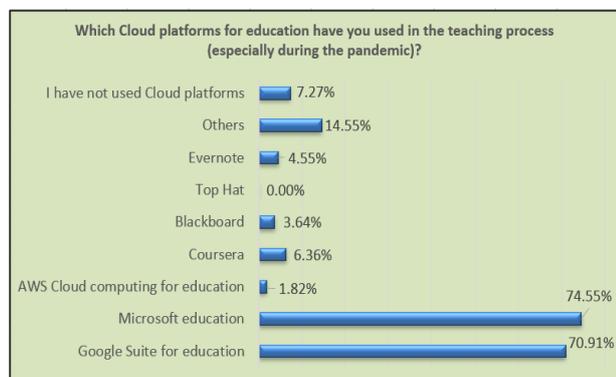


Figure 10. Cloud platform that respondents have used (especially during pandemic)

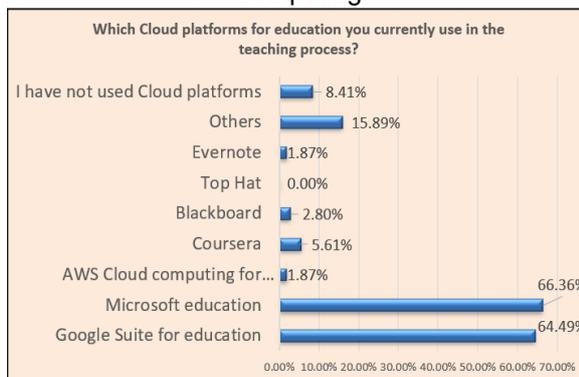


Figure 11. Cloud platform that respondents currently use

Cloud computing is a model of delivery of information resources based on new advanced technologies. The advantages of Cloud computing make it applicable in many areas, including in education, especially in developing countries such as Republic of North Macedonia. By applying of this model, universities in developing countries can have access to the latest advanced tools for on-line teaching and learning without investing large financial resources. According to the results of the research in this paper, most of the respondents are familiar with the concept of Cloud Computing, or even 83%, which can be seen from Figure 9. But not only are they familiar with the concept of Cloud computing, also a large part of them have already used or currently use some Cloud platforms/tools in teaching and learning process. Due to the pandemic, educational institutions had to adapt to the changed conditions and most of the teaching and learning process took place on-line. Also, in the Republic of North Macedonia, universities completely switched to distance learning. During that period, as can be seen from Figure 10, most of the respondents used learning platforms from the largest providers in this area, Google (70.91%) and Microsoft (74.55%). Academic staff in the Republic of North Macedonia in the past period, and especially during the pandemic, also used other Cloud platforms/tools for teaching and learning,

such as Coursera, Evernote, Blackboard, etc. The use of Cloud platforms/tools has relatively decreased in the period after the pandemic, but still today a significant number of academic staff use Cloud applications for teaching and learning. Again, the most used platforms are Google Suites for Education (64,49%) and Microsoft Education (66,36%) and their tools. After all, as the largest providers of Cloud services, Google and Microsoft have the largest share of the market and have the widest range of tools. Although Cloud platforms/tools are currently used less than during the pandemic, there is a satisfactory level of use of Cloud platforms/tools in higher education.

According to the obtained results of the research, the respondents use these Cloud platforms in all three cycles of study. Namely, 38% of the respondents constantly use Cloud services in the first cycle of studies, 40% in the second cycle of studies and 30% constantly Use Cloud services in the third cycle of studies. On the other hand, the number of academic staff who do not use Cloud services at all is very small, or 10% on the first cycle of studies and 17% on the second cycle of studies. The fact that 30% of respondents do not use Cloud services at all in the third cycle of studies is interesting, which is a really large percentage. The reasons for this can be various and require a more detailed analysis.

Cloud computing offers great advantages and benefits for universities in the Republic of North Macedonia. According to the results obtained with the research, where a Likert scale was used to examine the opinion of the academic staff, most of the respondents strongly agree with the benefits offered by Cloud Computing. The benefits of using Cloud computing it can be seen from the Figure 12 where the benefits are listed and they are: Improved cooperation between students and professors, More flexible education process, More efficient education process, Greater availability of learning resources, Improved learning facilities, A modern learning environment attractive to students, Easier monitoring of students in the learning process, Scalability (possibility of constant upgrade of the system) and Access to a number of learning tools.

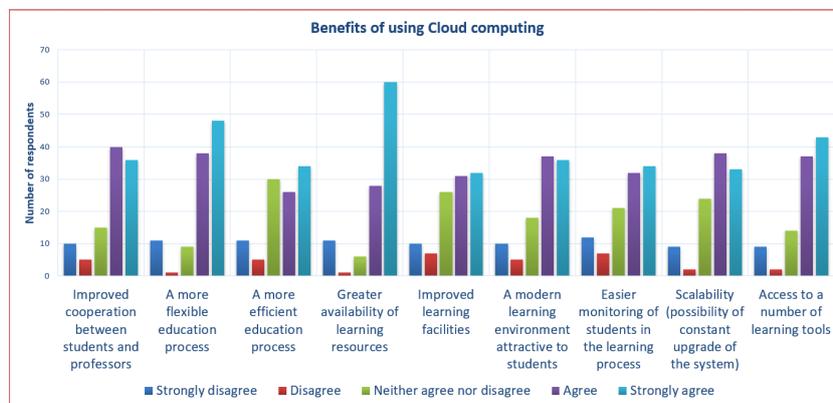


Figure 12. Benefits of using Cloud computing

Beside the advantages and benefits, the Cloud computing concept also faces certain challenges and problems. The results of the research indicate that the biggest problems faced by the respondents are: Poor social interaction between the participants, Poor internet connection and High digital knowledge is required. This can be seen in Figure 13.

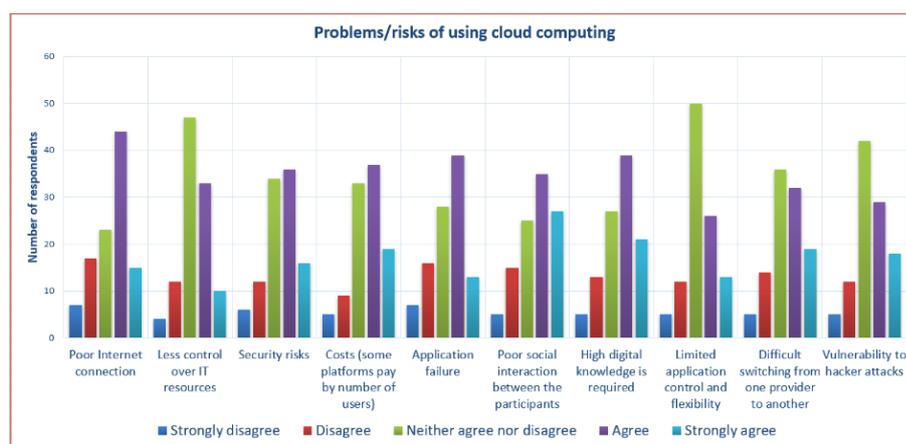


Figure 13. Problems/risks of using Cloud computing

However, when a comparison is made between the benefits and problems faced by Cloud Computing, the future trends will be in favor of Cloud Computing. The reason for that is because the benefits of using the Cloud Computing concept are far greater than the problems and challenges faced by this concept. That fact is confirmed by the results of the question about the future of Cloud computing, which can be seen in Figure 14. According to the results, most of the respondents believe that cloud computing will have a bright future, especially in Higher Education in the Republic of North Macedonia.

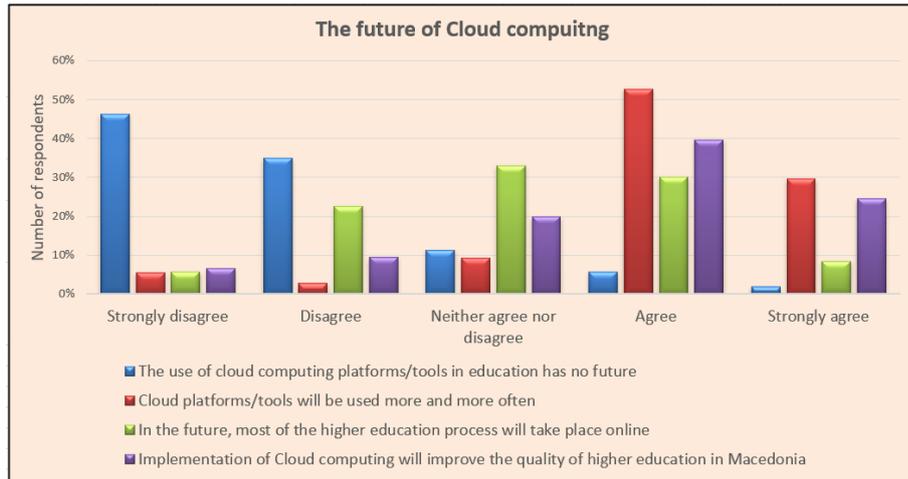


Figure 14. The future of Cloud computing in higher education

In this research, the results about which model of teaching and learning is most preferred by the respondents are quite interesting. As can be seen from Figure 15, according to these results, most of the academic staff prefer combination of online teaching and physical presence (hybrid model), or 73% of them prefer this model of curriculum implementation. Probably, in the future, this model of hybrid teaching and learning will be applied more often in order to meet the needs of students, but also to take advantage of the benefits offered by new technologies and models.

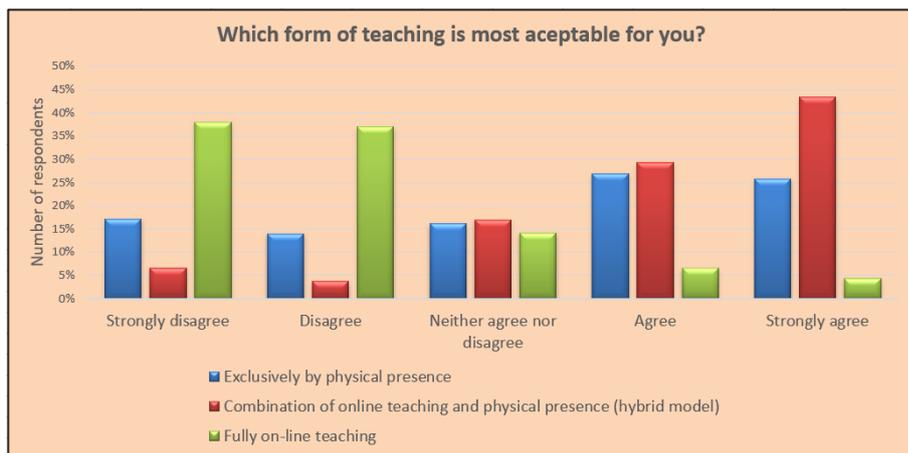


Figure 15. Preferred form of teaching

After the detailed analysis of the obtained results through cross-tabulations, interesting results were obtained. Due to the limited size of this paper, several cross-tabulations that are interesting for analysis will be presented. This analysis i.e., cross-tabulations were made with pivot tables in Excel and the obtained results are shown in the tables below.

According to the results in Table 1, most of the respondents who are familiar with Cloud Computing are aged 35-45 (84%), while most of such respondents are in the scientific fields of Engineering and Technology (87.5%) and Humanities (88, 88%). When it comes to the size of the institution where they work, most of the academic staff who are familiar with Cloud Computing work in institutions with 30-40 employees (81,82%), while most of the associate professors (86.96%) are familiar with this concept.

Table 1. Cross-tabulation, Are you familiar with Cloud computing - Age of respondents

Are you familiar with the concept of Cloud Computing?	Age of respondents			
	25-35 years	35-45 years	45-55 years	55-67 years
Yes	60.00%	75.61%	84.00%	72.73%
I'm familiar with it, but haven't used Cloud service	10.00%	14.63%	4.00%	6.06%
No	30.00%	9.76%	12.00%	21.21%

Table 2. Cross-tabulation, Are you familiar with Cloud computing – Scientific field

Are you familiar with the concept of Cloud Computing?	Scientific field in which you work?					
	Agricultural Science	Medical and Health Science	Social Science	Natural science	Engineering and Technology	Humanities
Yes	83.33%	55.56%	68.89%	62.50%	87.50%	88.89%
I'm familiar with it, but haven't used Cloud service	0.00%	11.11%	13.33%	25.00%	3.13%	0.00%
No	16.67%	33.33%	17.78%	12.50%	9.38%	11.11%

**Table 3. Cross-tabulation, Are you familiar with Cloud computing – Number of employees**

	Number of employees in Higher education institution (faculty, institute, school)?			
	10-20 employees	20-30 employees	30-40 employees	Over 40 employees
Are you familiar with the concept of Cloud Computing?				
Yes	62.50%	72.73%	81.82%	75.00%
I'm familiar with it, but haven't used Cloud service	25.00%	18.18%	4.55%	7.35%
No	12.50%	9.09%	13.64%	17.65%

**Table 4. Cross-tabulation, Are you familiar with Cloud computing – Academic Ranks**

	Academic ranks of respondents			
	Assistant	Associate professor	Docent	Full Professor
Are you familiar with the concept of Cloud Computing?				
Yes	42.86%	86.96%	65.22%	78.57%
I'm familiar with it, but haven't used Cloud service	14.29%	4.35%	21.74%	5.36%
No	42.86%	8.70%	13.04%	16.07%

The following cross tabulation refers to the Form of teaching and learning in relation to certain characteristics of the respondents. As can be seen from Table 5, in institutions with 20-30 employees, teaching and learning methods with the support of information technology are most often used (63,64%), while in the scientific fields of Humanities (77,78%) and Medical and health sciences (66,67%), this method of teaching is most often used. When a comparison is made with Table 2, out of all scientific fields, the majority of Medical and Health Sciences are not familiar with Cloud Computing, and on the other hand, they usually apply teaching methods with the support of information technology. Also, teaching with the support of information technology is usually used by assistants who belong to the youngest category of employees, which can be seen from Table 7 and Table 8. However, even though the assistants use the teaching with the support of information technology (85,71%), a large part of them or 42,86% are not familiar with the Cloud Computing model (Comparison of Table 4 and Table 8). The reasons for such distortions in the obtained results can be very different from the lack of knowledge of the essence of Cloud Computing (lack of adequate training) to the nature of the teaching process, depending on the scientific field in which they work. There are often cases when a user applies some kind of Cloud service, but he does not know that it is a Cloud platform/tool.

**Table 5. Cross-tabulation, of Form of teaching – Number of employees of respondents**

	Number of employees in Higher education institution (faculty, institute, school)?			
	10-20 employees	20-30 employees	30-40 employees	Over 40 employees
Which form of teaching do you most often apply?				
Conventional (traditional) way of teaching	0.00%	9.09%	0.00%	1.47%
Conventional way of teaching with minimal support of information technology	25.00%	18.18%	31.82%	32.35%
Teaching based exclusively through using information technology	12.50%	9.09%	13.64%	10.29%
Teaching with the support of information technology	62.50%	63.64%	54.55%	55.88%

**Table 6. Cross-tabulation, Form of teaching - Scientific field**

	Scientific field in which you work?					
	Agricultural Science	Medical and Health Science	Social Science	Natural science	Engineering and Technology	Humanities
Which form of teaching do you most often apply?						
Conventional (traditional) way of teaching	0.00%	0.00%	2.22%	12.50%	0.00%	0.00%
Conventional way of teaching with minimal support of information technology	16.67%	11.11%	42.22%	25.00%	25.00%	22.22%
Teaching based exclusively through using information technology	16.67%	22.22%	8.89%	12.50%	12.50%	0.00%
Teaching with the support of information technology	66.67%	66.67%	46.67%	50.00%	62.50%	77.78%

**Table 7. Cross-tabulation, Form of teaching - Age of respondents**

	Age of respondents			
	25-35 years	35-45 years	45-55 years	55-67 years
Which form of teaching do you most often apply?				
Conventional (traditional) way of teaching	10.00%	2.44%	0.00%	0.00%
Conventional way of teaching with minimal support of information technology	10.00%	39.02%	32.00%	24.24%
Teaching based exclusively through using information technology	10.00%	9.76%	20.00%	6.06%
Teaching with the support of information technology	70.00%	48.78%	48.00%	69.70%

**Table 8. Cross-tabulation, Form of teaching - Academic Ranks**

	Academic ranks of respondents			
	Assistant	Associate professor	Docent	Full Professor
Which form of teaching do you most often apply?				
Conventional (traditional) way of teaching	14.29%	0.00%	4.35%	0.00%
Conventional way of teaching with minimal support of information technology	0.00%	30.43%	39.13%	30.36%
Teaching based exclusively through using information technology	0.00%	8.70%	21.74%	8.93%
Teaching with the support of information technology	85.71%	60.87%	34.78%	60.71%

When it comes to the dynamics of using Cloud platforms/tools in teaching process, the obtained results are shown in the following tables. In addition, cloud computing is most often used in institutions with more than 40 employees (55.22%), while the scientific field where respondents often use Cloud applications are in the Humanities (66.67%). According to the results of Table 11, Cloud platforms/tools are often used by the academic staff aged 45-55 (52%), and according to Table 12, Cloud computing is often used by Full professors (57.14%).

**Table 9. Cross-tabulation, of Dynamics of use Cloud computing – Number of employees of respondents**

What are the dynamics when using a Cloud tool/application during the implementation of the curriculum?	Number of employees in Higher education institution (faculty, institute, school)?			
	10-20 employees	20-30 employees	30-40 employees	Over 40 employees
I don't use any Cloud tool/app at all	12.50%	27.27%	13.64%	7.46%
I use it in every class during the realization of the curriculum	50.00%	9.09%	22.73%	13.43%
I use it only a few times during the implementation of the curriculum	12.50%	27.27%	22.73%	23.88%
I use it often when implementing the curriculum	25.00%	36.36%	40.91%	55.22%

**Table 10. Cross-tabulation, Dynamics of use Cloud computing - Scientific field**

What are the dynamics when using a Cloud tool/application during the implementation of the curriculum?	Scientific field in which you work?					
	Agricultural Science	Medical and Health Science	Social Science	Natural science	Engineering and Technology	Humanities
I don't use any Cloud tool/app at all	33.33%	11.11%	11.11%	12.50%	6.45%	11.11%
I use it in every class during the realization of the curriculum	16.67%	11.11%	17.78%	37.50%	19.35%	0.00%
I use it only a few times during the implementation of the curriculum	16.67%	55.56%	17.78%	12.50%	25.81%	22.22%
I use it often when implementing the curriculum	33.33%	22.22%	53.33%	37.50%	48.39%	66.67%

**Table 11 Cross-tabulation, Dynamics of use Cloud computing - Age of respondents**

What are the dynamics when using a Cloud tool/application during the implementation of the curriculum?	Age of respondents			
	25-35 years	35-45 years	45-55 years	55-67 years
I don't use any Cloud tool/app at all	30.00%	12.50%	4.00%	9.09%
I use it in every class during the realization of the curriculum	50.00%	17.50%	12.00%	12.12%
I use it only a few times during the implementation of the curriculum	0.00%	20.00%	32.00%	27.27%
I use it often when implementing the curriculum	20.00%	50.00%	52.00%	51.52%

**Table 12. Cross-tabulation, Dynamics of use Cloud computing - Academic Ranks**

What are the dynamics when using a Cloud tool/application during the implementation of the curriculum?	Academic ranks of respondents			
	Assistant	Associate professor	Docent	Full Professor
I don't use any Cloud tool/app at all	42.86%	13.04%	13.64%	5.36%
I use it in every class during the realization of the curriculum	42.86%	26.09%	18.18%	10.71%
I use it only a few times during the implementation of the curriculum	0.00%	21.74%	22.73%	26.79%
I use it often when implementing the curriculum	14.29%	39.13%	45.45%	57.14%

The results obtained with these analyzes are quite interesting and a number of conclusions can be drawn. Due to the limited size of the paper, we are not able to present additional analyses, but this scientific paper can be a good basis for further research.

## CONCLUSION

The new conditions created by the development of advanced information technologies enabled the application of new teaching and learning methods. Modern educational systems must adapt to these changes caused by the development of new technologies. The cloud computing concept in general, as well as cloud computing platforms and tools for teaching and learning, are already a reality and a need for universities in the implementation of their curricula. The transition from the traditional, conventional way of teaching to teaching using Cloud platforms/tools will allow students greater access to educational materials, but also improved collaboration between students and professors. After all, the expectations of the students are getting higher in terms of what the universities offer them, so the Higher education institutions have to meet such increased demands. The application of new teaching and learning methods will enable students to come out more prepared and more competitive in the labor market.

Through this research paper, we tried to present the real situation in the use of Cloud platforms/tools in higher education in the Republic of North Macedonia, as well as the benefits, expectation and challenges faced by the users of these applications. The results of this survey provide answers to many interesting issues. It is encouraging that most of the respondents are familiar with the concept of Cloud Computing and often use such platforms/tools in the implementation of curricula. According to the results of the research, most of the respondents use the platforms that are the most famous on the market (Google Suite for education and Microsoft education) and that also have the largest number of users worldwide. But in addition to these platforms, users also use a number of other distance learning tools (Coursera, Evernote, Blackboard and many others), although the use of these applications is on a smaller scale. According to these results, universities were forced to transfer their entire work on-line during the pandemic, but very positive trend is that, even after the end of the pandemic, a large number of universities continued to use these platforms for distance learning. It is probably due to the fact that most of the academic staff is already aware of the benefits of these platforms, which was shown by this research. In the part of the research that refers to the benefits offered by cloud computing, most of the respondents answered affirmatively. All this points to the fact that the cloud computing model, as one of the ways to modernize teaching and learning methods, has a bright future. This was also confirmed by the survey, where most of the academic staff agree that Cloud Computing will be an increasingly used tool for the realization of curricula in the future, as support for the teaching process. For increasing the use of Cloud platforms in the Republic of North Macedonia, probably one of the biggest problems is the lack of adequate training and education for the academic staff

to use these tools. Perhaps that is why certain contradictory results were obtained during the cross-tabulations, because some of the respondents probably use Cloud platforms/tools, but are not aware of it. The problems faced by the application of the Cloud computing model such as Poor Internet connection, Application failure, Costs, Difficult switch from one to another provider will be overcome with the further development of technology, so this concept will be an integral part of the higher education process in the future, both in the world and in the Republic of North Macedonia.

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**Dinko Jukić, Ph.D.**

Trade and Commercial School "Davor Milas"  
 Osijek, Croatia  
 dinkojukic.phd@gmail.com

## VIDEO GAME INDUSTRY: A MARKETING PERSPECTIVE

### Abstract:

**Purpose:** The study discusses the importance of branding and the video game industry. Emphasis is placed on brand analysis. The phenomenon of the happiness industry and the video game industry are discussed.

**Methodology/approach:** The research is based on relevant theories of brand management. The study starts from the construct of brand identity according to Kapferer and brand image according to Keller. The context of happiness and the entertainment industry is analysed according to Davies.

**Results:** The paper researches and analyses distinct brands in video games. Video game branding is analysed from the aspect of marketing communication. Brand categories in video games are suggested. Also, the economic impact of the games was analysed.

**Conclusion:** The video game industry is a large market that has overtaken the music and film industries in terms of revenue. Video games should be viewed in a wider social context as a generator of new jobs, creation of new value, but also as a cultural phenomenon. Branding in the video game industry is important for two reasons: creating greater visibility and consolidating an existing position in the market. In other words, we see the brand in video games as an evolutionary process of digital marketing, but also as a digital imprint of an existing brand.

**Limitations/future research:** This study is theoretical and starts from a qualitative methodology, i.e. thematic literature analysis. Further empirical research can be conducted on different game types, consumer type and by gaming platform to identify the existing market.

**Keywords:** brand, culture, customer, game, marketing, video game

## 1. INTRODUCTION

*It's all about the game and how you play it.*  
 (Motörhead, 2002)

Everything is a game. According to play theorists such as Caillois (2001), Fink (2000), Huizinga (1992), and Sutton-Smith (2001), *homo ludens* represents any individual for whom play is voluntary and takes place outside of reality. However, no matter how much the game is separated from reality, it occupies its own space and time. We can understand the game as a form of unique adaptive variability, but also as a way of life. Play constitutes culture and is an integral part of civilization. The concept of play exists in all segments of society: as a word game, seduction, conquest, strategy, mathematical theory, and as philosophy. In the broadest sense of the word, the game reflects not only the state of the individual but also his cultural level. The game is part of the culture.

Understanding the game as a part of culture, we can observe the game from the aspect of marketing in culture (Colbert, 2010, p. 38-44). According to Griswold (2004, p. 13), a cultural object is a concept that refers to the way society interprets and gives meaning to certain artefacts and ideas. In this sense, a video game becomes ideal as a concept of a cultural object. Specifically, we understand the game as a form of consumer need that we materialize into video games. In this sense, video games represent a certain product, a brand that fulfils the consumer's wishes (Solomon, Bamossy, Askegaard & Hogg, 2006, p. 52-54).

The topic of this study is research into the social phenomenon of gaming, the video game industry, and game branding. This means that the study starts from the marketing analysis of the brand image in the context of video games. What is crucial is about viewing the video game as a brand. The game is viewed in a wider sociological and anthropological aspect as a cultural object that is a symbol of fun, relaxation, and happiness. Does this mean that the brand shapes media messages through games? Do video games create needs and desires by reflecting simulations in the digital landscape? After all, isn't that just another name for a postmodern marketing paradigm in which marketing semiotics takes the place of the industry of happiness? If so, what are the marketing strategies for building virtual happiness? Can the video game industry be considered a serious industry, or will we continue to underestimate it?

This study opens some new and closes some old questions. These are questions about the relationship between desires, needs, and image. In more detail, these are questions about the marketing strategy of building satisfaction and brand image. The image of a better life. So, let the games begin!

This study is interdisciplinary. It starts from researching the phenomenon of play, a video game, and explores its connection with the concept of a cultural object and branding. Also, the phenomenon of the industry of happiness and entertainment relates to the concept of a video game, which we understand in a broader sense. In other words, it also starts from the postmodern marketing paradigm (Brown, 1995; 2001).

The study starts from the analysis of relevant literature related to the cultural game theory. Qualitative content analysis was used. The paper uses an analytical method (Willig, 2013, p. 101-109) and the method of phenomenological approach. Keller's theory (2013) was used for brand image, and Kapferer's theory (2008) for brand identity analysis. The paper uses theories of play according to the concept of *homo ludens* (Huizinga, 1992), rhetoric of play (Sutton-Smith, 2001), and categories of play (Caillois, 2001).

The aim of the paper is to research, present and analyse game phenomenon in the context of marketing and the video game industry. The value of this scientific study comes from an in-depth insight into the phenomenon of video games from the aspect of marketing. This is especially evident in the interdisciplinary insight into the sociological, cultural, and anthropological context of the video game.

Thematically, the study is divided into two parts. In the first part, the phenomenon of the game is discussed. In the second part, the video game is analysed from the aspect of brand and society. The limitation of the study arises from the position of qualitative research. The study presents theoretical models. In further research, the models presented in this study can be verified, especially the brand models in games.

## 2. AMBIGUITY OF VIDEO GAME

The concept of play can be seen as a form of human work. This means that the phenomenon of play according to Huizinga (1992, p. 11-15) has a deeper meaning. In particular, the game includes norms, user skills, but also hidden meanings. It is precisely these hidden meanings, i.e. the symbols that represent the game, which reveal to us that it is not an end. It represents life and is characteristic of everyone. In terms of marketing, a video game represents a materialized consumer desire.

At the same time, the play always involves the question of reality. The attempt to define the play is very ungrateful because the game contrasts with a serious, standardized, and strict concept, which when examined in more detail is a vague concept that can best be described as non-reality (Huizinga, 1992, p. 13). The game is also a free act that allows the player (user, consumer) a certain freedom, leisure, and fun. Play is an intermezzo of everyday life (Huizinga, 1992, p. 16). Play, however, is an act of culture. It is meaningful in its playfulness and as such transcends social boundaries and enters the metaphysical.

Studying the phenomenon of play is not only a field of psychology, pedagogy, and philosophy. The play is much more than that. In the cultural sense, the play is a product of culture and an integral part of it. In other words, play is a human need and is woven into the consumer's core. Precisely in this sense, the phenomenon of play symbolically connects the consumer's need for freedom, rest, and entertainment.

According to Caillois (2001, p. 12-27), we distinguish four categories of play: *agon* (competition), *alea* (luck), *mimicry* (imitation) and *ilinx* (enthusiasm). The first category of games, *agon*, represents games that include competitions, based on qualities such as endurance, speed, strength and skill. *Alea* represents a game based on luck, which means that the player is passive, and the outcome does not depend on skill, speed, and training. In contrast to the mentioned categories, *mimicry* represents the acceptance of an illusion, i.e. it is based on imitation and simulation. The key in the category of mimicry is the imitation and simulacrum of the world. Finally, *ilinx* presents a category of games based on enthusiasm, excitement, and vertigo. Therefore, it is about inducing rapture in the player by changing his perception and making him disoriented (see Table 1).

**Table 1:** Brand strategies by video game category

Category	Characteristics	Brand strategy	Video game
Agon	Consumer competition	Brand image	Call of Duty: Black Ops
Alea	Games of fortune	Brand emotion	Gwent
Mimicry	User mimicry	Brand endorsement	The Witcher 3: Wild Hunt
Ilnix	Consumer perception	Brand archetype	Assassin's Creed Valhalla

Source: author

As seen in Table 1, video game characteristics direct access to brand strategies. *Agon* represents a whole group of video games that start from the competence mode, and emphasizes practice, effort, and the desire to win. This category imposes discipline and represents the pure substance of an individual's value (Caillois, 2001, p. 16). In this sense, the category *agon* represents a form of consumer affirmation, i.e. creating a favourable self-image that is characteristic of the brand image (Keller, 2013, p. 76-79). The category *alea* means games of chance, and what is specific is precisely the passivity of such a user who starts from a game of risk invested and gained. In this sense, the role of ale is the suspension of skills in favour of the theory of probability, and the marketing implications are manifested according to appeals to happiness and satisfaction.

The third category of *mimicry* represents a form of consumer acceptance of a certain illusion of an individual and temporary rejection of identity to imitate another. An example of this category can be found in the adventure video game genre, i.e. the user's imagination is key to this feature of mimicry. It is also very noticeable when identifying the main character in a movie, game, or sport where the famous person's role is used as a brand promotion. Finally, the category *ilinx* starts from causing dizziness, rapture, and spasms (Caillois, 2001, p. 23) which changes the perception of reality. This category can serve as a form of brand archetype construction (Mark & Pearson, 2001, p. 105-119).

B. Sutton-Smith (2001) presents seven rhetoric of play. This rhetoric's are different perspectives through which the game can be interpreted. These are the areas: a) progress, b) fate, c) power, d) identity, e) imaginary, f) self, and g) frivolity (see Table 2). In the rhetoric of progress, the rhetoric is usually applied to the game and advocates that users adapt and evolve through the game (Sutton-Smith, 2001:18-26). In the context of video games, this could be understood as games that encourage cognitive development, like puzzle games that encourage logical thinking. In the rhetoric of fate, it is usually applied to games of chance and gambling with the belief, that human lives and the game are controlled by fate (Sutton-Smith, 2001, p. 52-67). In video games, this could be understood as games that include elements of randomness. Rhetoric of Power is applied to competitive games with the belief that the game is about controlling the conflict (Sutton-Smith, 2001, p. 74-83). In video games, this could be understood as competitive games like eSports.

**Table 2:** Video game characteristics and rhetoric

Rhetoric	Characteristics	Video game
Rhetoric of Progress	Pre-exercise theory, puzzle games	Portal
Rhetoric of Fate	Destiny theory, lottery games	Hearthstone
Rhetoric of Power	Extrinsic motivation, competitive games	League of Legends
Rhetoric of Identity	Jung's theory, archetypes games	The Sims
Rhetoric of the Imaginary	Symbolic interactionism, sandbox games	Minecraft
Rhetoric of the Self	Intrinsic motivation, casual games	Animal Crossing
Rhetoric of Frivolity	Huizinga's theory, party games	Guitar Hero

Source: author

As Table 2 demonstrates, the rhetoric of identity applies to traditional celebrations that are seen as a means of asserting the power and identity of the player community (Sutton-Smith, 2001, p. 91-107). In video games, this could be understood as games that allow players to express their identity, such as open-world games where players can customize their characters. Rhetoric of the imaginary applies to playful improvisations that encourage creativity and innovation (Sutton-Smith, 2001, p. 127-143). In video games, this could be understood as games that encourage creativity, like sandbox games. Rhetoric of the self applies to independent activities where play is idealized by attention to experiences of fun, relaxation, and escape (Sutton-Smith, 2001:173-196). In video games, this could be understood as games that allow players to relax and escape from reality, such as casual games. The Rhetoric of frivolity is applied to the activities of the idle, which is seen as a playful protest the established orders of the world (Sutton-Smith, 2001, p. 201-207). In video games, this could be understood as games that are meant for pure fun and laughter, such as party games.

In the following, we will explain Table 2 on the example of a video game. A game like *Portal* that encourages players to solve complex puzzles using a portal gun, thus encouraging logical thinking and problem solving is an example of rhetoric of progress. Game *Hearthstone* that includes elements of randomness in the drawing of cards and the results of battles is an example of the rhetoric of fate. *League of Legends* is highly competitive game where players must work together to defeat the opposing team is an example of the rhetoric of power. A game like *The Sims* where players can customize their characters and express their identity through a virtual world represents the rhetoric of identity. A game like *Minecraft* that encourages players' creativity by allowing them to build and shape their world as they wish is a prime example of the rhetoric of the imaginary. The *Animal Crossing*, game that allows players to relax and escape from reality through simple and relaxing activities like fishing is an example of the rhetoric of the self. Finally, a game like *Guitar Hero* meant for pure fun and laughter with friends is an example of the rhetoric of frivolity.

According to W. Davies (2017), the concept of the *happiness industry* refers to the idea that happiness has become a commodity in modern society. Davies explains that the modern happiness industry encourages us to monitor our own body and mind, and even turn it into an obsession. Happiness becomes a disciplinary technique of managing society. The goal of the happiness industry is to make happiness a disciplinary technique for managing society. This industry

encourages us to monitor our own body and mind, often turning it into an obsession (Davies, 2017, p. 69-74). Happiness is consumed because the entire concern for well-being and functionality is transferred to individuals and the entrepreneurial self. In other words, accident risk outlines our inability to contribute to the economy and general well-being (Davies, 2017, p.197-203).

In the context of marketing, the happiness industry is used to create products, services and experiences that promise happiness, well-being, or an improved quality of life. This can include everything from wellness products and services, meditation apps to video games that sell feelings of happiness and contentment (Jukić, 2021; 2022). The concept of the happiness industry can be related to video game marketing. In the context of video games, the happiness industry can be used to create games that promise happiness, well-being, or an improvement in the quality of life of the player.

### 3. VIDEO GAME AS A CULTURAL OBJECT AND A BRAND

According to Griswold (2004, p. 13-19), a cultural object can be anything that people use to express their cultural ideas, values, and beliefs. It can be a work of art, a book, a movie, a video game, or festival. Cultural objects are important because they help us understand how society works and how cultures change over time. The term *cultural object* in this context means culture in the broadest sense of the term, emphasizing its creative part. It is precisely the cultural object or culture that contains and shares *meanings* that are common and understandable to all members of a society.

Cultural objects are understood as symbolic elements of cultural tradition, and the purchase of brands represents an extension of the consumer's self-concept. The status of a cultural object results in an analytical point of view, it is not embedded in the object itself. It is the same with the brand. Brand image is the consumer's projection. A cultural object is created by people; they are the ones who add meaning to it. All others in this communication process are participants and users who build a relationship with the cultural object through experience. Signs that have complex meanings according to Griswold can be understood as symbols, and their complexity is reflected in the whole spectrum of different meanings that individual symbols can contain. Which meaning users (consumers) will accept will depend on the context of their interaction, experience, and expectations. Baudrillard (2017, p. 28-31) argues very similarly in the context of simulacrum, but so does Brown in the context of postmodern marketing.

The connection between video game and culture is understood as a higher form of play. This means that the game, if it originates from the user's satisfaction, can be viewed as a need. Formal characteristics of play, such as freedom, cultural act, place, and duration can be applied to video games. The feature of freedom of video games represents escape from reality, adventure, and fun (Davies, 2017). We can then connect the game with the concept of free time.

Therefore, we understand the video game as the embodiment of consumer needs, which represent a marketing niche for the unreal and imaginary. This follows the understanding of the concept of the happiness industry in which the video game serves as a guide to virtual happiness, satisfaction and fulfilled desires for adventure and fun. This means that virtual games, among other things, can be defined as a form of marketing communication, and the content of digital media itself represents communication with consumers (Jukić, 2020). This refers to culture in the most general sense (Williams, 2013, p. 63), which represents a form of communication and reproduction.

Video games are one of the fastest growing media in postmodern society. Video games create new social discourses that need to be thoroughly analysed (Rokošný, 2018:59). If we assume that games are a subset of play, then we start from the premise that games are formalized while play is simplified. Play and fun are vastly subjective topics that relate to the individual and are not the domain of sociology under normal circumstances (Dietkow, 2023, p. 29). However, in this study, video game users are observed in accordance with the understanding of Dietkow (2023, p. 30), that is, as an engaged gamer. Also, the very act of playing and understanding the game as fun, beauty and happiness is understood in the context of Jukić (2022, p. 49). This means that the gamer is seen as an engaged consumer, a loyal brand consumer.

In this sense, from a marketing point of view, we can make a distinction between casual gamers and gamers who represent the target market. Video games are becoming an integral part of the market. According to research conducted by Baltazarević et al. (2023, p. 42), most users react positively to the appearance of brands in video games.

In postmodern marketing consumer is looking for new experiences in virtual reality. The consumer's experiences, his experiences and emotions derive from the simulation of reality, from the *ludens* (Huizinga, 1992) of the virtual world. In this sense, the brand image, that is, the formation of the consumer's multi-layered identity and self-image (Keller, 2012), represents only one fragment of postmodern marketing. Video games as a transmedia cultural form have a significant role in shaping communication patterns of consumer behaviour (Kerr, 2006), social structures and cultural consumption.

Observing video games from the aspect of the brand, we can conclude that the influence of marketing semiotics (Jukić, 2021) and postmodern marketing (Brown, 1995) shapes the meanings of video games in the context of media messages. In this sense, marketing semiotics can be viewed in the context of postmodern marketing (Solomon, Bamossy, Askegaard & Hogg, 2006, p. 52-54; Hoyer, & MacInnis, 2010, p. 456) as part of integrated marketing communication in the video game industry. From the consumer's point of view, a brand is an experienced, emotional, and perceptive creation. Consumers form beliefs about brand attributes in diverse ways.

To create a brand in a video game, several conditions must be met. First, it is necessary to create the identity of the video game. This means that the video game must have a certain recognition, add value and meaning to the users. Brand image represents the consumer's perceptions, impressions and beliefs about a product or service. This recognition

represents the identity of the brand. Brand identity is a set of associations about the brand that the manufacturer develops and directs to users (Veljković, 2010, p. 199). This means that elements of the brand identity are responsible for communicating with consumers. Second, brand image is closely related to the concept of the consumer's self-concept (Veljković, 2010, p. 94). In other words, consumers prefer those brands that reflect their values, beliefs, and visions.

To create the brand image of a video game, the key groups are a) functional features, b) social features and c) psychological features. Functional features represent the video game itself, i.e. the game engine, graphics, story, and gameplay. Social features include reference groups, i.e. virtual communities, social networks, WOM, and the influencer effect. Finally, the third group of features are the consumer's desires, emotions, and behaviour. The first two features that create the brand image of a video game are shaped by the publisher and are the result of integrated marketing communication.

According to the Customer-Based Brand Equity (CBBE) model, consumers do not differentiate between the source of associations and the way they are formed (Keller, 2012, p. 68). Consumers value the strength, affection, and uniqueness of a brand. This means that consumers can form brand associations in several ways. Unique associations help consumers in choosing a brand. In this sense, brands in digital games (Table 3) are presented through five categories: a) brand in the game, b) game as a brand, c) protagonist as a brand, d) publisher as a brand, and e) game mode as brand.

**Table 3:** Brand types in video games

Brand type	Digital brands
Brand in the game	BMW
Game as a brand	Final Fantasy
Protagonist as brand	Lara Croft
Publisher as brand	Naughty Dog
Game mode as brand	Dark Souls

**Source:** author

The first category is real brands that exist, and users find them in the virtual world and games. Those in the virtual world serve to increase the reality in video games. According to Kotler and Keller (2012, p. 260-265), brands in the virtual world are ideal as a form of advertising because users want to see brands. The second category is games that have become brands due to their recognition, uniqueness, and originality. These are usually video games that have a longer tradition of existence or have advanced the genre. These are video games that are recognizable at all levels of brand identity and are perceived by consumers through visual, auditory, symbolic, and metaphorical elements (Keller, 2012).

The third category is protagonists as brands, that is, when the main character from the game becomes so recognizable and specific that it represents the entire video game, as well as itself. Such a digital brand that is based on a character's head is a carrier of meaning that can be transferred to other games or media. The fourth category is the manufacturer's brand, i.e. the corporate brand that represents, symbolizes and associates not only video games but also corporate culture, corporate communication and even the community of users. Finally, the category game mode as brand represents a specific style, recognizable way of playing and improvement of the game. It is important to emphasize that brand categories can overlap.

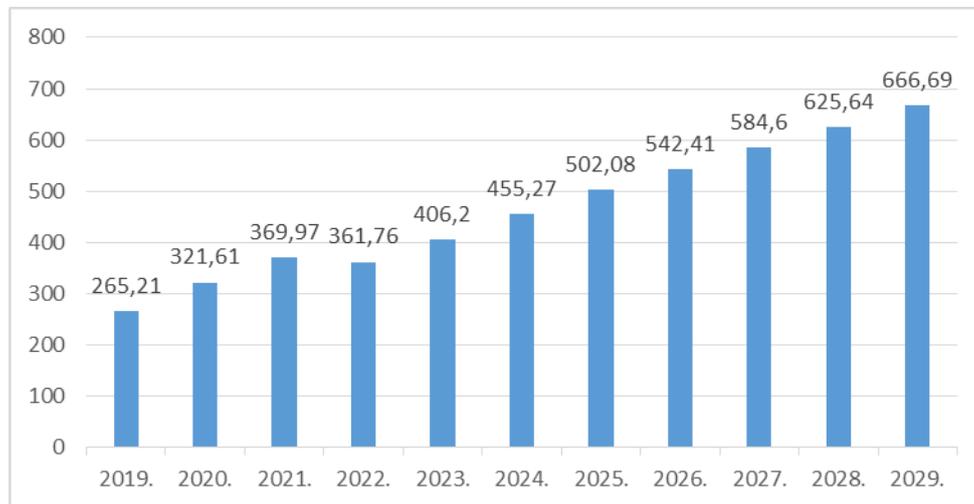
This means that various categories overlap and reflect in one virtual game, such as the example with the video game *Uncharted*. More precisely, a video game can develop a special engine, recognizable music, create a protagonist who represents the game series and improve the entire genre. The first step in creating the market value of a brand starts from creating brand awareness through the creation of associations with certain brands. After a certain level of brand awareness is created (Keller, 2012, p. 76) we create a brand image. Creating a positive brand image requires marketing strategies that connect unique brand associations. If we compare the *ilnix* category (Table 1), then we can take as an example the video game *Assassin Creed Valhalla*, which unites excitement, adventure, and rapture in the archetype of a strong and dominant brand. Of course, Callios' category can be expanded by comparing other video game categories, so we can also have a mimicry type of a strong hero.

Another type of association with the video game brand is brand benefits, which according to Keller are understood as personal values and meanings that consumers attach to the product itself, i.e. the game. When we compare the suggested categories of brands (Table 3), then the video game Tomb Raider becomes a brand, but at the same time its protagonist becomes the bearer of meaning, therefore a brand. Finally, if we compare the mentioned two video games according to rhetoric, specifically rhetoric of the imaginary, then we see that we can analyse the video game brand from the aspect of game category, game type and area.

However, if we explore the concept of cultural object and brand, we get the common characteristics of the video game as a cultural symbol as well as a brand. The video game *Uncharted* can be considered a cultural object because it represents certain ideas, values and beliefs through its story, characters, design, and gameplay. Players and critics can interpret and analyse these elements to understand what the game is trying to communicate and how it relates to broader cultural trends. On the other hand, *Uncharted* is also a brand. It has a distinctive logo, style and reputation that sets it apart from other video games. Sony and Naughty Dog, the companies behind the *Uncharted* series, use this brand to promote the game, attract players and make a profit. As a cultural object and brand, *Uncharted* plays a significant role in

the video game industry and culture in general. This game not only provides entertainment, but also shapes the way we think about video games as a medium and an art form.

Analysis of trends in the video game industry confirms that the dominant business strategy can be presented as vertical integration in the production cycle. Global revenue in the video game segment (Statista, 2024) is projected to grow continuously between 2024 and 2029 for a total of 211.4 billion US dollars (+46.43 percent). After a seventh consecutive year of growth, the indicator is estimated to reach \$666.69 billion US dollars and therefore a new peak in 2029. When video games are compared to other industries, recent estimates suggest that the video game industry generates significantly more revenue. The global gaming industry experienced a significant increase during the COVID-19 pandemic as many consumers turned to gaming for fun and socializing.



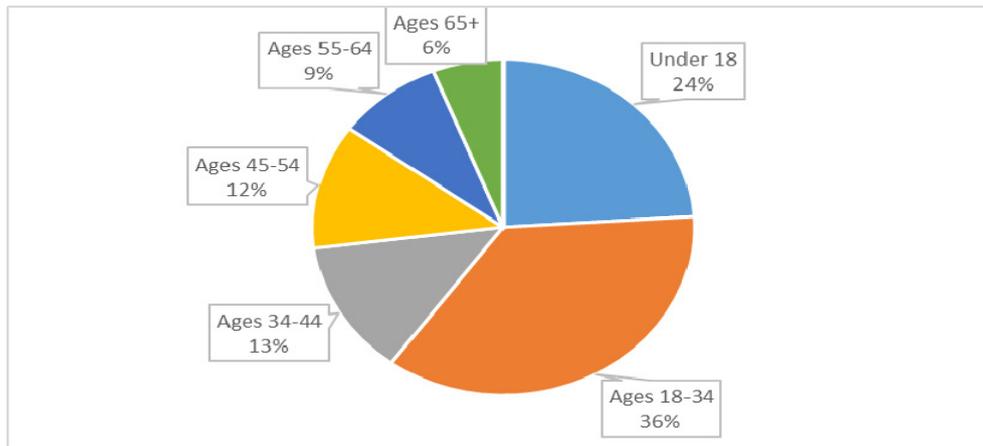
**Picture 1:** Video game market revenue worldwide from 2019 to 2029

**Source:** adopted from Statista (2024)

According to a survey by the Entertainment Software Association (ESA) during the COVID-19 pandemic, video games were a source of relaxation, entertainment, and happiness for 55% of users, and 90% of the total respondents said they would continue to play (ESA, 2021, p. 4). It is particularly interesting that 71% parents stated that they need entertainment and rest, but also that the perception of video games has changed from the aspect of pedagogy, specifically 63% considered them useful for learning as well. When comparing consumer perception of video games from the aspect of the happiness industry, 93% say that video games bring joy through play, 91% say that video games provide mental stimulation, and 89% provide stress relief from video games (ESA, 2022, p. 4).

If we look at the industry's hardware support for the video game using the example of the Sony PlayStation console, which has sold more than 158 million units worldwide by the beginning of 2024 (Statista, 2024), it is clear how important this market is. We note that the revenues generated from Sony video games and online services amounted to 25.96 billion US dollars, making them the largest Sony segment in 2022. From the above, it is evident that video games generate revenue from hardware and software aspects. If we add to that the average age of video game consumers, it is evident that video games are experiencing a renaissance.

The average age of players is 33 years, and across all ages 76% of players are over 18 years (Picture 2). If we consider the sociological-psychological context of players as well as the demographic aspect, using ESA data, a clearer picture of the future of the video game industry, as well as the profile of gamers, is provided. In other words, the largest number of gamers who once started playing video games, they do not stop, but on the contrary, they transfer their culture of virtual entertainment to the household.



**Picture 2:** The video game player community  
**Source:** adopted from ESA, 2022, p. 7.

This means that the trend of buying video games will increase. For example, 72% of players see benefits of games for existing relationship, and 89% of players see benefits of games for new relationship (ESA, 2022, p. 7). If we compare player habits and preferences according to the category of device on which they play games (see Table 4), we can conclude that marketing strategies should focus on the smartphone and console markets.

**Table 4:** Preferred device for playing

Preferred device	Proportion
Smartphones	70%
Console	52%
PC	43%
Tablet	26%

**Source:** adopted from ESA, 2022

Video games generate more revenue than movies and music. On the other hand, the movie and music market are smaller compared to the video game market. If we compare the year 2016, the global revenues from video games exceeded 101 billion US dollars, which is significantly more than the global revenues from music and movies combined (Statista, 2024). Also, the advantages of the video game industry are symbiotic to other aspects. In particular, the development of new video games requires the development of computer hardware such as the production of graphics processing units, graphics cards and faster memory. In other words, the development of video games encourages the development of accompanying services, such as the development of the music, IT, and media industries.

## 4. CONCLUSION

In this study, we researched and analysed the impact of the video game industry from a cultural and marketing perspective. The game is understood as part of culture. Caillois' category served as a conceptual model of video game branding strategy. These categories can be used for further analysis and research. The influence and importance of the video game industry in a wider context is explained.

Video games represent a cultural, media and marketing phenomenon. The concept of playing exists in all civilizations and is therefore universal. We can see the game as a form of work, but also as a form of fun and relaxation. When we look at a video game from the aspect of relaxation and entertainment, then we are talking about the concept of the happiness industry. On the other hand, when we look at the video game as a form of media literacy, then it becomes the bearer of certain values and meanings. Finally, when we look at the game from a marketing perspective, we understand it as the consumer's desire for rest, fun and relaxation.

The video game industry synergistically affects the development of society through new jobs in the field of video games as well as a high rate of income growth of +46.43%. Analysing video games from the perspective of brand theory (Kapferer, 2008; Keller, 2013), five brand categories were proposed: brand in game, game as brand, protagonist as brand, publisher as brand, and game mode as a brand. Video games are presented as a cultural object that tends to become a brand. Also, video games are not only brands, but they are also a catalyst for unique brands, franchises, and extensions. In this sense, video games represent the realization of the postmodern marketing paradigm. Video games represent the consumer's need for entertainment and happiness to the mutual satisfaction of the consumer and the producer.

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e-mail [cristina.criste@e-uvt.ro](mailto:cristina.criste@e-uvt.ro)**Ciel Bovary (Man)**

Global Entrepreneurship, Economics and  
Management Master Programme, West  
University of Timisoara,  
Timisoara, Romania

e-mail [ciel.man00@e-uvt.ro](mailto:ciel.man00@e-uvt.ro)**Oana-Ramona Lobont**

Finance Department, Faculty of Economics  
and Business Administration,  
Timisoara, Romania

e-mail [oana.lobont@e-uvt.ro](mailto:oana.lobont@e-uvt.ro)

## **PORTRAYING THE LEVEL OF DIGITAL PERFORMANCE AND INNOVATION OF THE EUROPEAN PUBLIC SECTOR: CONTEXTUALISING THE RELATIONSHIP BETWEEN E- GOVERNMENT AND DIGITAL INNOVATION**

**Abstract:** Due to the differences among European Union member states in governance quality, public governance effectiveness, financial resource management, and efforts to improve economic performance and well-being, digital innovation is essential for promoting digital governance. Achieving qualitative e-governance requires increased innovation, along with the effective adoption and implementation of digital technology. The main objective of this study is to analyse the connections between public governance and digital innovation in the European Union (EU). Two research methods were considered to carry out the longitudinal data compiled at the EU-27 member states (EU27) level from 2017 to 2022: bibliometric and Gaussian and mixed-Markov graphical (GGMs) analysis. This methodology allows a comprehensive approach to evaluating the interaction of digital innovation with public governance. Scientific documents from the period 2010-2023 from the Web of Science were analysed to explore the relationship between e-government and digital innovation. The analysis revealed that this subject is relatively new, with the most productive years being the last five years. It also identifies the countries and authors in this field that are most concerned and the most relevant documents. Based on GGMs and correlation analysis, the empirical part focused on digitalisation, innovation, world governance indicators, and economic variables from 2017 to 2022 across EU member states to identify links between these variables. Our findings support our assumption that digitalisation and innovation positively impact e-government services. The results reveal the need for countries to align their digital transformation plans to integrate digital technologies and continuous innovation to improve e-government effectiveness. Successful implementation of e-government relies not only on technology but also on well-planned strategies, adequate resource allocation, ongoing innovation, and governmental dedication to ensure accessible, secure, and user-friendly e-services for all citizens. The findings underscore the necessity for countries to reconfigure and align their digital transformation plans by integrating digital technologies into service delivery while continuously promoting innovation to improve the performance of e-government.

**Keywords:** graphical models, bibliometric analysis, e-government, digitalisation, innovation

### **1. INTRODUCTION**

This study examines and contextualises the relationship between e-government and digital innovation in the European Union (EU27). Thus, our research aims to thoroughly study how the public sector in the EU performs in terms of its digitalisation services while also considering the best practices employed by some EU governments and how those can be translated into an EU-wide policy.

In this complex framework, this research focuses on determining the relationship between the public sector and digital innovation and how these two specific things interplay with one another. The analysis is grounded in two advanced approaches: thorough bibliometric analysis and Gaussian and mixed-Markov graphical analysis (GGMs). The findings emphasise that the public sector and digital innovation have a strong relationship with one another, showcasing that digitalisation has a very important role in assessing the performance of the public sector.

Digital technology has implications in all aspects of the national economy, notably aiding in the solution of problems and introducing novel technology and operational procedures. The growing interest in digitalisation is due to its ability to streamline operational efficiency, reduce working time, and improve e-government and public sector quality. To fully harness the potential of digital technology and ensure its effective implementation, governments should prioritise data-enabled digital governance (Arner et al., 2022). The importance of public sector development for the national economy is confirmed by the fact that many European Union member states are currently implementing complex and comprehensive programs to develop public sectors through digitalisation projects to improve their economies. Due to the disparities in the quality of governance between the member states of the European Union, it is necessary to have good public governance, a sufficient distribution of governmental funds, and rational public spending both in less developed countries and in developed ones.

There are two approaches that may be taken to the process of digital transformation: adding value via complexity and adding value through digital innovation, where the government can impact citizens' participation in public service delivery (Lopes et al., 2019). Doran et al. (2023) state that e-government is the solution for modernising and improving the efficiency of public administration. E-government supports modelling a specific type of public governance, where the presence of information and web services does not necessarily prove the presence of a communication channel but the emergence of a new philosophy of participatory bureaucracy management. Pathak et al. (2007) suggested that e-government could aid eradicate corruption and establish a strong link between the government and the citizens.

Implementing novel technological advancements for improving the e-government in different institutions faces many challenges; the majority of these difficulties differ between nations and between different e-government models. Beniwal et al. (2013) identified several challenges that may arise in the e-government process: technical infrastructure constraints (current telecommunication infrastructure is deficient, outdated equipment), financial limitations (such as the price of an internet membership and the limited availability of internet service providers in some locations, which makes it challenging for residents to obtain online services).

The current situation, nuanced by the pre-Covid 19 and post-Covid 19 periods, has demonstrated the importance of digital resources for a country's economy. Internet access, connectivity, artificial intelligence, and digital skills have supported the economy and facilitated its smooth functioning. The COVID-19 pandemic accelerated the transformation of the digital intensity of public and private institutions, forcing the adoption of digital tools, whose mission was to ensure the continuity and sustainability of the respective sectors. A significant number of information and communication technologies underpin the infrastructure of the digital economy (Nasution & Bazin, 2018). Introducing digital tools in the public environment (e-tax, e-transport, e-health) will benefit society, the government, and the dynamics between the government and citizens. The global pandemic has accelerated technological advancement in government services, compelling governments to reconsider their approaches to serving all societal segments (Mergel et al., 2019). Institutions and public administrations have seen several irreversible changes as digital governance has grown structurally and in terms of how governments and citizens interact.

The literature on the topic generally concurs that the relationship between e-government and digital innovation is synergistic and complementary. Authors have pointed out that the link between digital innovation and e-government leads to better public services, reduced waiting times, decreased bureaucracy, and increased citizen engagement with public authorities. Furthermore, the link between e-government and digital innovation is bidirectional (Mirandilla-Santos, 2008) and has a symbiotic relationship (Shofia et al., 2020).

This research contains a few significant additions. We might contend that our research's innovation in relation to earlier studies is influenced by the way empirical analysis is carried out, particularly the techniques employed, and the way the research framework was created. In this complex framework, this paper is an innovative attempt to investigate the links between the public sector and digital innovation in the European Union (EU) member states by utilising two advanced research methods: the bibliometric analysis using the R bibliometrics package and the Gaussian and mixed-Markov graphical (GGMs) analysis. We are able to showcase the pattern and strength of relationships between all the factors taken into consideration for the EU-27 nations by employing the mixed-Markov Graphic Model. Components of the Worldwide Governance Indicators and Digital Economy and Society Index were chosen as indicators to highlight the interaction between e-government and digital innovation. Furthermore, the recorded results indicate a dynamic and stable long-term interconnection between e-government and digital innovation. Also, a mutual influence (bidirectional) was identified between these two phenomena. The empirical findings are in line with the model developed by Hinings et al. (2018), which explored the interaction between digital innovation and transformation and government policy uncertainty, which in our case is represented by digital innovation and e-government.

The research paper is structured as follows: section 1 explains the link between the public sector and digital innovation while also sharing insights into the criticism of the public sector and the disparities between the EU member states. Section 2 is devoted to the bibliometric analysis. Section 3 highlights the methodology employed, and Sections 4 and 5 state the data utilised for our research and the results. The conclusion is presented in Section 6.

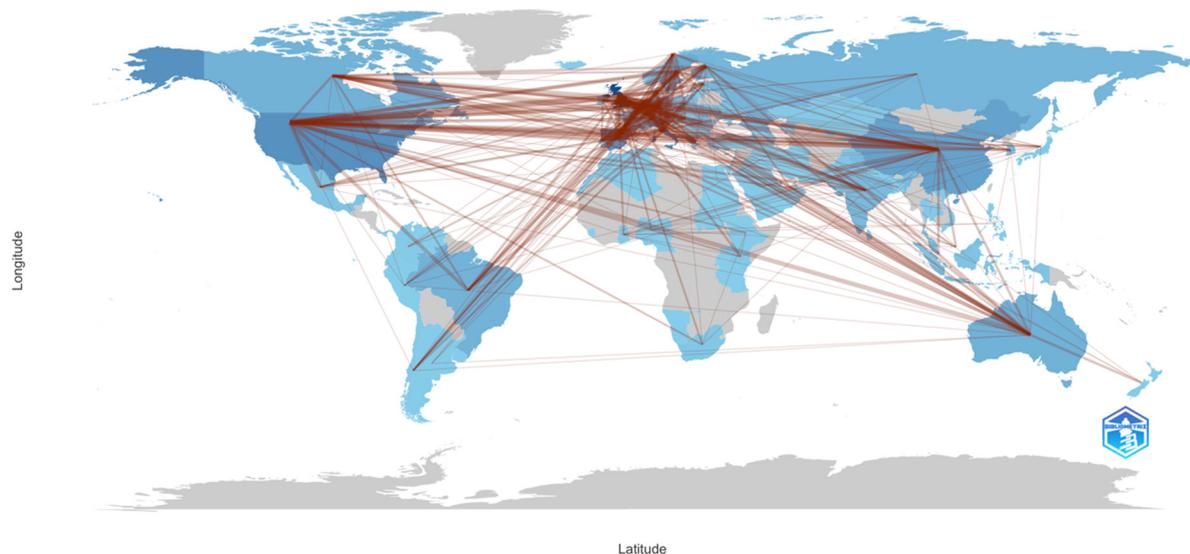
## 2. BIBLIOMETRIC ANALYSIS

We have considered bibliometric analysis to understand better the available literature on the nexus between the public sector and digital innovation. The bibliometric analysis is a valuable technique for identifying trends in the literature and evaluating the calibre and significance of the available literature, which also aids in analysing and displaying the intellectual, conceptual, and social components of research and the dynamic elements of its evolution. The types of analysis that can be produced with the help of bibliometric analysis are vast and varied, such as citation analysis, co-authorship analysis, keyword analysis, author analysis, institutional analysis, citation network analysis, and collaboration analysis. Moreover, the choice of employing the R software, as opposed to other software, is because the R Studio's bibliometrix package offers greater flexibility, customisation, and advanced statistical analysis thanks to the packages that it contains.

Using the R Studio's bibliometrix package, we conducted a thorough bibliometric analysis to identify key contributors and trends in our research field. This analysis highlighted the prevalent keywords, co-citation of author's countries, the word cloud, and a treemap, which provided valuable insights into the specialised literature.

The data employed for our study was retrieved from the Web of Science Core Collection on March 8, 2024. The search terms utilised were "public sector" and "digital innovation"; the selected type of documents were "article", "book chapter", and "proceeding papers", while the period of analysis was from 2010 until 2023. Therefore, after applying relevant filters, 1221 publications were retrieved and imported into R studio to be analysed using the bibliometrix package (biblioshiny function). In order to better analyse the relationship between the countries, the co-citation world map was employed. Picture 1 highlights the results, and 1850 entries underline an essential collaboration between nations. Namely, the collaboration between the USA, EU states, and China represent the bulk of the link strength, where USA – EU states have a frequency of 73. Moreover, there is a significant collaboration between EU governments, such as Italy and Spain with the frequency 11, Italy and France, and Germany with the Netherlands with 10.

Country Collaboration Map



**Picture 1:**Map of the co-citation of author's countries  
**Source:** author's own work in R studio "bibliometrix" package

Furthermore, by thoroughly analysing the frequency of the words that appear in the abstracts of the papers taken into consideration, Picture 2 showcases the words most often employed. Therefore, the top 5 most employed terms are innovation (193 frequency), management (118 frequency), e-government (69 frequency), governance (68 frequency), and public sector (66 frequency). Moreover, other additional topics such as "business", "performance", "organisations", "big data", "perspective", "policy", and "health" are also among the most used words related to the relationship between e-government and digital innovation. Thus, the link between the public sector and digital innovation is very interconnected, as technology plays an essential role in increasing the efficiency of the public sector.





Commission database; and last but not least, for the innovation indicators, the data sources employed were the World Bank and Eurostat.

Based on the research objective, contextualising the relationship between e-government and digital innovation, the data are arranged in four groups: digitalisation, innovation, e-government, and economic performance. The dataset includes indicators for the EU-27 member states for the period 2017-2022. The time sample was utilised considering the availability of the data. The variables included in the empirical models, which were organised into four dimensions, are represented by the following dimensions:

- Digitalisation: (i) World Bank-Individuals using the Internet (% of population) (IUI); (ii) Digital economy and society index – (ii) Integration of digital technology (weighted score (0 to 100) (IDT); (iii) Human capital - according to the skills of internet users (weighted score (0 to 100) (HC); (iv) Connectivity - by mobile broadband (weighted score (0 to 100) (CMB); (v) Advanced Skills and Development, by ICT Specialists (weighted score (0 to 100) (ADVS);
- E-government: Digital economy and society index - (i) e-Government Users (Percentage of individuals who used Internet within the last 12 months) (EGOV), (ii) Digital Economy and Society Index - Digital Public Services-by e-government (weighted score (0 to 100) (DPS), (iii) Digital Economy and Society Index e-Government Users (weighted score (0 to 100) (OP); (iv) Eurostat- Digital public services (weighted score (de la 0 la 100) (Internet);
- Innovation: Eurostat- (i) Gross domestic expenditure on research and development (R&D), (ii) R&D personnel and researchers by sector of performance (fields of R&D and sex) (P\_R&D), (iii) GERD by sector of performance and fields of R&D (GERD\_R&D);
- Economic performance: Word Bank- (i) GDP growth (annual %) (GDPg); (ii) Unemployment, total (% of the total labour force) (Unempl); Eurostat- (iii) GDP per capita (annual %) (GDP per Cap);

Following Yang et al. (2023), Noja et al. (2019), and Dima et al. (2016) were the researchers who employed using similar indicators and related methodological credentials.

Table 1 contains specific descriptive data for each indicator utilised in the econometric models.

**Table 1:** Descriptive statistics of the data employed in the analysis

Variable	Mean	Sd	Min	Max
CMB	16.197	5.837	8.052	39.120
ADVS	14.030	1.780	6.333	26.660
HC	24.869	6.181	10.460	38.560
IDT	4.698	2.761	-1.073	12.385
IUI	85.311	7.981	31.130	98.865
OP	7.638	2.987	2.487	13.928
EGOV	65.062	18.920	12.090	94.084
DPS	61.929	16.826	10.271	99.640
Internet	70.588	12.684	31.130	90.610
Unempl	6.594	3.302	2.015	21.41
gdp	2.838	4.312	-11.167	15.125
GDP_per cap	2.589	4.455	-11.600	18.732
GERD_r&d	11626	22342	65.928	121164
Pr&d	106601	165164	1529.700	782904
R&d	1.6855	0.888	0.460	3.490

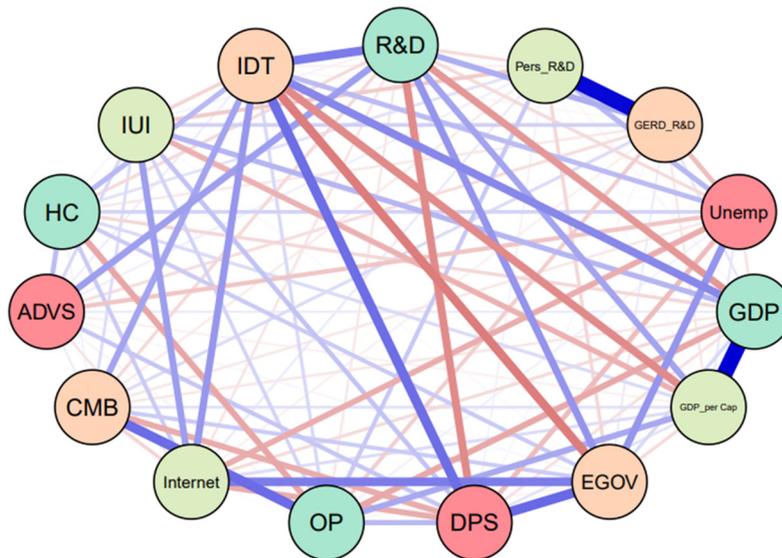
**Source:** author's own processing in Eviews.

Regarding the dimensions of economic performance (ECON), the summary statistics (Table 1) highlighted that unemployment (unempl) recorded the highest index for Greece (21.41) and the lowest for the Czech Republic (2.015). However, GDP per capita (GDP\_per cap) recorded the maximum value for Croatia (133590.1), with Spain at the opposite pole (-11.60). Regarding the digitalisation dimension (DIGIT), individuals using the Internet (IUI) variable recorded the maximum value in Denmark (98.86) and the minimum value in Italy (63.07). As for DESI components, ICT Specialists (ADVS) recorded the highest average value (13.00) among the three other dimensions–human capital, connectivity, and digital technology integration–with the highest maximum value (over 26 in Sweden) and the lowest minimum value (over 6 in Greece and Romania). Regarding gross domestic expenditure on research and development (R&D), the minimum value (0.46) is in Romania, and the maximum value (3.49) is in Slovakia. High values were obtained between the four components for the integration of digital public services (e-government), with an average value above 63, and significant discrepancies were obtained between EU-27 countries, which stated the minimum interval (Romania 10.27) and maximum interval (Sweden, 99.64).

## 5. RESULTS

To investigate our research hypothesis, "there are strong connections (both positive and negative) between the aspects of digitalisation (including innovation) and digital public service credentials", we have created and evaluated two graphical models, based on GGM and MGM, using extensive Bayesian information criteria and partial correlation.

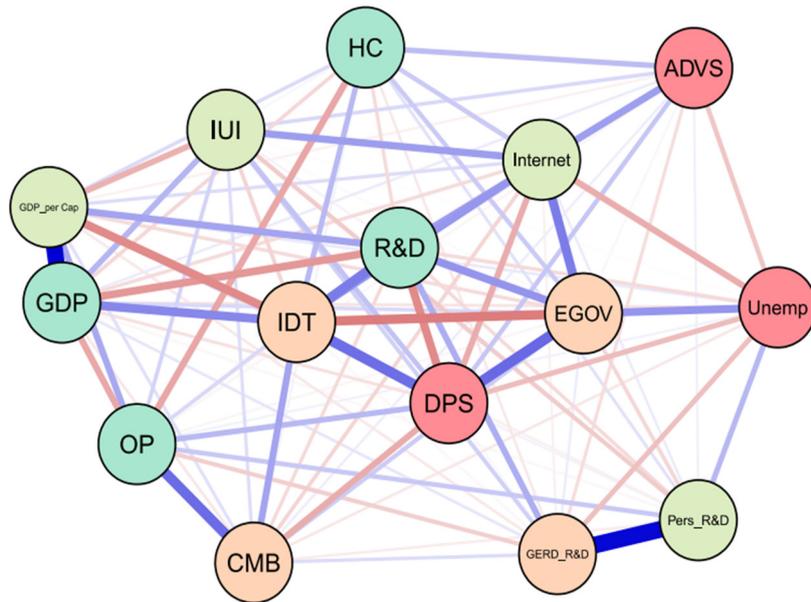
GGMs were analysed using partial correlation, extended Bayesian information criteria/contracting operator, and absolute minimum selection for the period 2017–2022. Each indicator represents a node in the configured network connected to other nodes by significant paths, reflecting their interdependencies. Estimates were made using two methods: estimation using partial correlation and those based on the Bayesian EBIC information criterion (Picture 5).



**Picture 5:** Results of the Gaussian graphic model (GGM)

**Source:** author's own work in R studio

A Gaussian graphical model (GGM) (Picture 6) highlights the strong interconnections between all the variables. The integration of digital technology (IDT) is noted in the network, being closely associated with Digital Public Services (DPS), GDP growth (GDP), Connectivity (CMB), and Research and Development (R&D). Gross domestic exposure to research and development (R&D) also has a partly positive correlation with the integration of Advanced Skills and Development (ADVS), e-government users (percentage of individuals who used the Internet over the last 12 months) (EGOV), and GDP per capita (GDP per\_Cap). Digital Public Services (DPS) are also positively correlated with individuals using the Internet (IUI), advanced skills, and development of ICT specialists (ADVS) and Open Data (OP). Thus, our research hypothesis was confirmed. There are significant overall (positive and negative) implications of the dimensions of digitalisation and innovation on e-government in EU-27 countries.



**Picture 6:** Results of the Mixed-Markov Graphic Model (MGM)  
**Source:** author’s own work in R studio

In the Gaussian Graphic Model (GGM) presented in Picture 6, stronger links capture various associations related to digital innovation and the dimensions of e-government. These include positive links with the integration of digital technology (IDT) associated with gross domestic exposure on research and development (R&D), with GDP, Digital Public Services (DPS), connectivity (CMB), and so on, Human Capital (HC), and Open Data (OP). On the other hand, there are negative synergies with individuals using the Internet (IUI). A favourable influence on gross domestic exposure on research and development (R&D) is observed in GDP per capita growth (GDP per\_Cap), Integration of Digital Technology (IDT), Internet use: finding information about goods and services (Internet), and e-government users (EGOV). On the other hand, adverse influences are identified regarding Internet users who use fewer activities involving digital devices, such as other online activities (HC) and public services that have integrated digital technologies (DPS).

Thus, the findings are consistent with the ones found by Kuhlmann and Heuberger (2021) and Arief et al. (2021), highlighting that innovative digital technology is generally considered a potential solution for alleviating pressure on the digitalisation of the public sector.

Considering the findings, tailor-made strategies for public policies for integrating digital technologies and continuous innovation are required to improve the effectiveness of e-government. These are particularly necessary in areas such as digital public services, internet users, and connectivity through digital means, aiming to enhance the integration of digital technologies into digital public services and establish appropriate regulations to increase citizens' confidence in using digital technologies in interactions with public authorities.

According to our estimates, using digital tools in delivering public services—such as e-government, open data, and citizens' proficiency with digital technologies and public services—improves the quality of e-government in the digital age. This is because digital technology helps to enhance and simplify several institutional aspects, including security, communication, high-quality service delivery, and institutional well-being. This finding was also supported by Mergel et al. (2019). Moreover, digital innovation can be closely associated with the efficiency of the government (Karkin et al., 2021), suggesting that these accreditations' beneficial effects may encourage the digital transformation of public government. However, it is essential to carefully manage the implementation of digital innovation in e-government initiatives to avoid unintended negative effects on public employees and citizens (Guo, 2011).

Based on GGM findings (Picture 5) and MGM (Picture 6), effective collaboration between policymakers and all societal sectors can improve the public sector's digital innovation. High-quality services, such as information sharing, quick communication, unfettered access to technologies, safe and sustainable digital infrastructure, and enhanced security and connection, result from integrating digital technology.

However, there are several drawbacks to digital innovation, including the need to enhance resource quality, the demand for novel services, technical inequalities, and policy conflicts that could result in particular ambiguities when it comes to the implementation of standard operating procedures (Windapo, 2021; Caruso, 2023; Chen et al., 2022). In addition, it is recommended that governments integrate information technology into several domains to foster societal advancement (Kamer, 2011).

## 6. CONCLUSION

This study analysed the relationship between the public sector and digital innovation. Two research methods were considered to assess the connections between the public sector and digital innovation in the European Union (EU): bibliometric, Gaussian, and mixed-Markov graphical models. Empirical results highlight that digital innovation has positively and negatively impacted e-government services in the European Union. These findings significantly impact understanding of the link between digitalisation and Digital Public Services in the EU-27.

Moreover, digital technology plays a crucial role in improving e-government effectiveness. However, Gaussian and mixed-Markov graphical analyses allow interaction between digital innovation and the public sector. The results also reveal that over the past few years (2017-2022), significant improvements in digital infrastructure have resulted in a more extensive incorporation of digital networks within the public sector. This has consequently facilitated more accessible access to information, aligning with the similar results reported by Tassabehji et al. (2019).

Moreover, the bibliometric analysis allowed the review of specialised literature by identifying and mapping the most cited keywords and the co-citation between them, the co-citation of the author's countries, and the most employed three-word groups. The results allowed the identification of the most relevant keywords, an analysis based on the countries in which the works addressed the relationship between the public sector and digital innovation.

Comparing the results for GGM and MGM of EU member countries for the period 2017-2022, innovation and e-governance of digitalisation have directly influenced economic performance, and we have demonstrated the significant (negative and positive) impact of digitalisation on e-government. Therefore, it can be concluded that nations with extensive digitalisation significantly influence the provision of Digital Public Services (DPS), along with the associated implications for intense innovation (R&D).

The main results indicate that countries with extensive digitalisation also demonstrate strong governance. Finland, Denmark, and Sweden recorded the highest levels of digitalisation intensity. Additionally, the findings showed that EU nations have accelerated their use of digital technology and the Internet in response to the COVID-19 pandemic and other unforeseen events, which have impacted public governance and additional macroeconomic and microeconomic side effects. Moreover, Romania and Bulgaria continue to present a low level of digitalisation in technological processes; this resistance to change can be attributed to the perception of digitalisation as a cost rather than a long-term investment.

Based on the findings of the study, several policy guidelines and recommendations can be suggested: (i) the EU states should ensure that their digital transformation strategies incorporate digital technologies and ongoing innovation to enhance the effectiveness of e-government; (ii) adequate distribution of resources, ongoing creativity, and government dedication are essential to ensure that electronic services are accessible, secure, and easy to use for everyone. Integrating digital technologies into service delivery while continually promoting innovation to improve e-government effectiveness.

Additionally, given these issues, we state that policymakers should broaden their scope beyond mere cost considerations to evaluate whether digital advancements improve value in delivering public services to citizens and generate broader socioeconomic advantages.

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**Zsuzsanna Gosi**

Eötvös Loránd University  
Faculty of Education and Psychology  
Budapest, Hungary

e-mail: gosi.zsuzsanna@ppk.elte.hu

**Norbert Ákos Zsembery**

Eötvös Loránd University  
Faculty of Education and Psychology  
Budapest, Hungary

e-mail: zsembery.norbert@ppk.elte.hu

## **SPORT-ORIENTED CORPORATE RESPONSIBILITY**

**Abstract:** Corporate social responsibility is becoming increasingly important in the way companies communicate and operate. One way of doing this through sport-focused actions. In the case of large companies operating in Hungary, we examined the issue through document analysis. For each company, we compared the actions oriented towards own employees, recreational sports and competitive sports. The results show that organizations can make use of the positive benefits of sport. In their operations, sport is present both in the business sponsorship area and in the area of charity.

**Keywords:** corporate responsibility, sponsorship, charity, sport-oriented

### **1. INTRODUCTION**

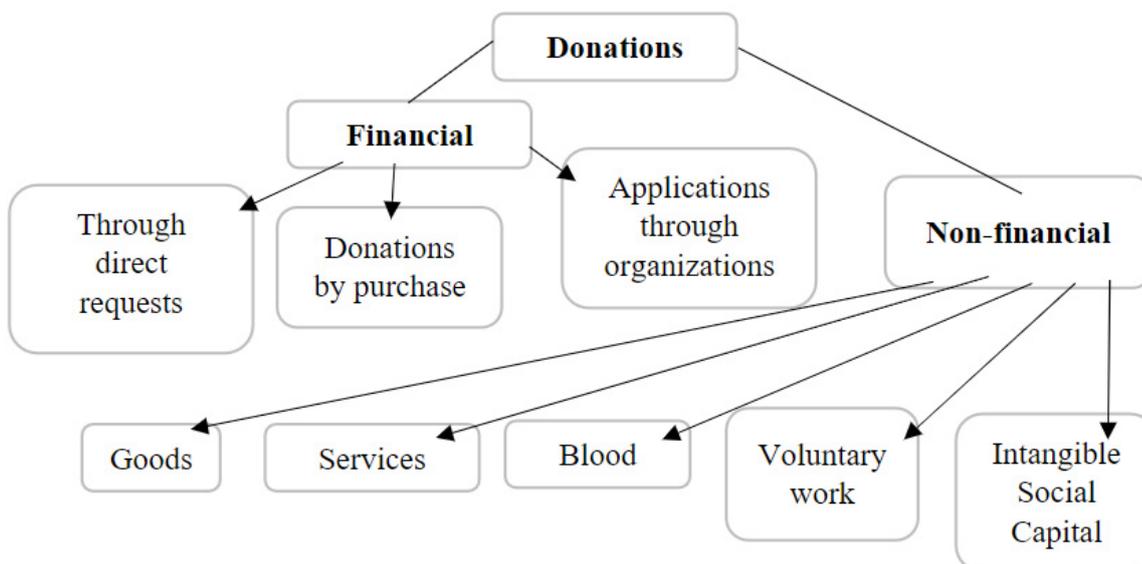
Social responsibility means that companies and other organizations consciously take responsibility for society and their environment. This may include ethical business practices, sustainability, environmental protection, addressing social issues, and community support. Corporate social responsibility can manifest in various forms and aims to promote positive social impacts and support sustainable development. For individuals, social responsibility entails being aware of the impact of their actions on society and actively contributing to the betterment of their community and environment. This could involve actions such as volunteering, charitable giving, ethical consumerism, sustainable living practices, and advocating for social justice issues. Essentially, it means taking responsibility for one's actions and striving to make a positive difference in society. Both individual and corporate responsibility often intertwine with sports events and sports organizations.

In this study we examine the sports-related CSR actions of companies operating in Hungary. The primary objective is to highlight the diversity of different actions. The research questions include the identification of sport-related CSR activities. To identify areas where companies are effectively implementing sport-related CSR activities. The research was carried out using document analysis methods, looking at companies' annual reports and public websites to answer the questions. We also sought answers to the question of the extent to which the corporate sector in a Central and Eastern European country is characterized by this type of action.

In the first part of the paper, the forms of co-responsibility are presented, both at individual and organizational level. It will then approach the topic from the perspective of how the literature addresses the relationship between sport and social responsibility. This will be followed by a presentation of sport-related CSR actions in specific companies.

## 1.1. Individual social responsibility

Volunteering and sponsorship, as well as peer-to-peer fundraising are all subject to individual responsibility. There are two known dimensions of it. One is Self-Personal Responsibility, while the other one being Individual Social Responsibility (Nárai & Reisinger, 2016). The meaning of Self Personal Responsibility is that the citizens take the responsibility for their own life. This includes living a lifestyle appropriate for physical-psychical welfare, tending of family environment, followed by paying attention to such direct environments as family or any other micro-environment. Individual Social Responsibility means stepping out of private personal spheres in order to take responsibility for closer or wider general environment. Social responsibility includes the individual responsibilities of volunteering and sponsorship. In a most general sense, charity means the selfless provision of aid. Charity can be simple volunteering but can also appear in the form of donations offered to groups or individuals in need, as well as to charity organizations (Czike & Kuti, 2006). A volunteer can either work as a “laic helper”, or by using his/her professional knowledge to help the development of certain communities (Nárai, 2012). Donation is a form of support either in financial or non-financial goods, offered for non-government-or non-profit organizations, denominations, public institutions as well as to individuals outside of their family or friendship spheres freely, without remuneration. Donations can be offered either by organizations or by individuals. Types and forms of donations are listed in Picture 1.



1. Picture forms and typed of donations (Arapovics, 2013)

Source: Mária Arapovics (2013): Sponsorship, Volunteering, Social Responsibility in Hungary. Andragogy and Education Theory page 54. 1/1

Individual philanthropy and donation appear in many places. One of the most unique forms of this is peer-to-peer fundraising. In this case, athletes, primarily recreational athletes, participate in a challenge and raise money for a charitable organization of their choice during the challenge. In case of peer-to-peer method, the fundraising is initiated by people committed to the given organization or cause. In this case, the advocates undertake individual challenges, such as running or swimming a certain distance – it can actually be a commitment to any personal, usually physical activity. The act of commitment is actually a communicational opportunity for the campaign. Advocates share the news within their social circles, seeking donations for their chosen organization. Therefore, it's a deeply personal endeavor where credibility and immediacy play crucial roles in fundraising. Its primary advantage lies in its ability to reach numerous new audiences as word of the campaign spreads. (Gösi & Magyar 2019, Gösi & Bukta 2021)

## 1.2. Corporate social responsibility

In recent decades, the role of companies in corporate social responsibility (CSR) has received increased attention from all angles. The concept itself (Corporate Social Responsibility) has been known since the

1970s and some elements of it have become part of everyday life. (Tóth 2021, Magyar – Szalkai 2015) The larger an organization, the greater its impact on its environment, and the greater the social expectations placed on it as it grows. Recognizing this trend, managers have moved CSR-related complementary objectives to the top of the priority list, in addition to profit maximization. These include sustainability efforts, gender equality and the health of colleagues and consumers. In addition, most researchers point to the need for public intervention to put the foundations of social responsibility in place. (Campbell 2007, Galaskiewicz-Burt 1991)

In Hungary, corporate social responsibility (CSR) is still a rarely utilized marketing tool, and companies often commit conceptual errors. Indeed, some organizations don't even leverage this opportunity presented by the 21st century. Conversely, several studies argue (Bevan et al., 2004; Babiak and Trendafilova, 2010) that we are talking about one of the most crucial segments of today's business and political life. The concept of CSR has existed since the 1970s, undergoing significant development over a few decades, with some of its elements becoming part of our daily lives (Deák et al., 2006; Magyar and Szalkai, 2015). „Within the framework of corporate social responsibility, companies voluntarily integrate social and environmental aspects into their business operations beyond their legal obligations and shape their relationships with stakeholders (consumers, employees, suppliers) based on these principles. A consciously formed attitude towards employee rights, anti-corruption, and business ethics differs from a solely profit-oriented approach...” (Deák et al., 2006: 4).

### **1.3.Sport and social responsibility**

The relationship between sports and corporate social responsibility (CSR) is a complex and multifaceted one Ráthonyi-Ódor (2017) and Paramio-Salcines (2013) both highlight the potential for sports to address social issues and the importance of integrating CSR into sports management. Smith (2007) further explores the role of sports as a vehicle for deploying CSR, emphasizing the potential for sports to bridge social and economic gaps. Hakala (2015) provides a practical perspective, discussing the role of sports in Finnish companies' CSR strategies, particularly in enabling sport participation and securing the integrity of sports. These studies collectively underscore the significant potential for sports to contribute to CSR efforts, particularly in addressing social issues and promoting well-being.

Sport and the sports sector are playing an increasingly significant economic role. This is reflected in various European expectations as well. Additionally, sports organizations strive to operate in increasingly modern forms. (Farágó 2024, Farágó & Kézai 2023) In modern societies sports have become an integral, almost substantive part of economy. Its role in society, however, is more complicated than this. Its role of mediating values is present in many scenes. One of the central elements of professional sports is the idea of fair play (Kassay 2017; Kassay 2019). In Hungary, the greatest traditions and popular base of voluntary work are connected to headline sports events. These events mobilize a plethora of young sports advocates (Onyestyák & Kállai, 2013). Among young people, school and University sports are also important areas of voluntary work (Bácsné Bába et. al, 2018). In this case, we can consider friendly atmosphere, love of sports and the opportunity for teamwork as highlighted motivational factors. This manifold complexity is supplemented by various charity sports events and methods of fundraising.

Companies (most of them) do not, of course, support, organize or even finance sports-related activities, athletes and sports organizations as a whole, purely for charitable purposes. Sport as a social phenomenon has an unquestionable power and its impact is felt at global and local level. It is therefore a very important macro- and microeconomic factor. (Nagy et. al. 2014) It shapes human thinking, and the way individuals and groups relate to organizations. And it may be in the interest of corporate management, at many levels, to play its part in this phenomenon, which transcends countries and continents.

## **2. CORPORATE CASE STUDIES ON THE RELATIONSHIP BETWEEN SPORT AND SOCIAL RESPONSIBILITY**

Taking into account several research studies (Smith and Westerbeek, 2007; Filizöz and Fişne, 2011; Trendafilova et al., 2013; Ibrahim and Almarshed, 2014; Ráthonyi-Ódor et al. 2017), there are seven main reasons why the link between sport and social responsibility has become so successful.

- The popularity of sport has enabled it to deliver its message to a wide section of society.
- CSR activities linked to a sports company or athlete are more attractive and interesting to younger generations.
- Sport - CSR can encourage physical activity.
- Sport - CSR promotes and increases social interaction.
- Sport promotes mutual acceptance and integration.
- Sport - CSR can raise awareness of sustainable development.
- Participation in sporting events helps to build well-being.

As can be seen from the above, there are many benefits to be gained when companies combine their CSR activities with sport. Practice shows that there is no difference in the fundamental concept to be implemented between sport and non-sport related CSR activities of companies active in sport. Sport-related activities can be found in both competitive and recreational sport.

## 2.1 Social responsibility of sport enterprises

Tóth's 2021 research compared sport-related organisations in terms of social responsibility. Table 1 shows the comparison. In the case of the two chosen sports companies, Decathlon Hungary distributes sports equipment and sportswear, while Ferencváros Gymnastics Club operates a football team.

**Table 1:** Comparison of sports companies

Characteristics	DECHATLON HUNGARY	FERENCVÁROS GYMNASTICS CLUB (FTC)
<b>Purpose of the company</b>	Community building	Gain competitive advantage
<b>Head of company</b>	Michel Leclercq: „ Make sport accessible to as many people as possible” “franchise operation”	Kubatov Gábor: „It is important for our club to keep in touch with fans. Our CSR activities are very important”
<b>Maturity of company</b>	The company has been operating for 40 years.	It was founded in 1899.
<b>Size of company</b>	More than 400 shops in 30 countries.	Regional market.
<b>CSR program</b>	Bild run, food distribution	Fradi school programme. „We are one” programme

**Source:** Toth, 2021

The two chosen sports companies take different paths in the organization of their programs. Decathlon, as a sponsoring organization, joins an initiative, while the Ferencváros Gymnastics Club creates the social responsibility actions itself.

The most successful program of the FTC (the sports company that produces the sporting event) is the Fradi Suli program, where players visit schools participating in the program. Thanks to this initiative, in three and a half years, more than 160 schools and 55,000 students have met successful Ferencváros athletes who raise awareness of the importance of learning and regular exercise.

Decathlon does not have famous athletes, which is why it has chosen a different "path". Their corporate philosophy is "to make sport accessible to as many people as possible", even for those with physical, mental or financial difficulties. They have a number of joint initiatives where they help other people - with different levels of disadvantage - to participate in sport by joining forces with an organization. One such initiative is Invisible Fitness, where blind and partially sighted people can take part in free aerobics classes courtesy of Decathlon, and the facilitators are also employees of the company.

## 2.2 Social responsibility at a recreational sports event

One important condition for charity is that as many people and companies as possible participate in it. The Budapest Sports Office, which organizes the largest street running races in our country, also offers several charitable opportunities. Running has become a way of moving the masses. Natural movements such as walking, running, jumping and throwing have been practised since prehistoric times (Gallovits et al, 2011). The popularity of running is due to the fact that there are opportunities to exercise almost everywhere. Jogging was introduced to American culture by James Fixx (Cselik, 2015). Today, running street races are extremely common, with widely varying distances. The breakthrough in making marathon running a mass sport came with the Hungarian-born Fred Lebow, who finally made amateur runners understand that, within certain limits, anyone can run the marathon distance without any special skills. The biggest marathons fill up in a matter of hours. In some cases, the only way to participate is by level or draw.

In addition to organizing running events, the Budapest Sports Office has been striving for years to get involved in various initiatives supported by charitable organizations. The two largest events organize separate races for people with disabilities, with free registration. They also assist in various fundraising campaigns. They continuously collaborate with the Brave Camp, which supports the rehabilitation of children with cancer.

A few years ago, the Budapest Sports Office introduced a new innovation for more efficient assistance: "Our online registration system offers a new, simple donation format. When registering for races, the system automatically presents one or more 'charitable products' assigned by us to the respective race category, which you can support by clicking, adding to your cart, and paying along with your registration. The base amount can be multiplied several times, as in an online store, if you purchase multiple units of a product. The 'charitable products' can also be purchased independently of registration. At the end of the campaign, BSI transfers the total amount collected as support to the designated organization." (Budapest Sport Office – BSI) As evident from the description, the Budapest Sports Office appears in various ways in the field of corporate social responsibility. However, it is also a fact that as a result, it receives more coverage in news reports, articles, and websites. This also means that these actions can yield returns in the business domain.

## 2.3 Social responsibility of food companies

In Hungary, several businesses appear as sponsors and supporters at recreational sports events. We selected two organizations from these. Coca-Cola has supported the women's running race held in Budapest for years. Spar has been the title sponsor of the largest marathon-distance running race in Hungary for years. Despite commonalities, numerous differences can be observed in the realm of corporate social responsibility. (Spar 2018, Spar 2023, Coca-Cola Hungary)

**Table 2:** Comparison of food companies

	<b>Coca-Cola</b>	<b>Spar</b>
<b>aims and values in sport</b>	encouraging people to take part in sport, supporting disabled athletes	the link between food safety and healthy lifestyles and physical activity as a result of their main activities
<b>focus areas</b>	professional and amateur sports, Olympics, all sports	recreational sports, running events
<b>partnerships and sponsorships</b>	Olympic movement, football events	Budapest Sport Office
<b>other social and environmental responsibility</b>	reducing environmental footprint, sustainability, more efficient water management	the importance of a sustainable future, social sensitisation
<b>communication channels</b>	offline, online, on-site	offline, online, on-site, mobile application

**Source:** own collection 2024

In summary, Spar Kft is also a company that strives to implement corporate social responsibility. It has a separate page on its website called "For a Sustainable Future." Within this, five different sub-areas are featured: for the environment, for health, for food safety, for employees, and for society. These activities were organized under a unified framework and umbrella brand in 2019. Sport appears in two programs for health and for employees, with the target audience presumably being different. The company group has been a sponsor partner of Budapest Sports Office for 15 years. Thanks to this, Hungary's largest participant marathon running event has carried this brand name for 15 years: "Spar Budapest Marathon."

The Coca-Cola company group holds a prominent market share both in Hungary and globally. Sport-focused CSR regularly appears in its communication. For decades, the company group has been organizing events and initiatives with a focus on sports. Their statements reveal that they aim to support both professional and amateur sports similarly. Through organizing various events and supporting specific organizations, their main goal is to encourage the population to engage in various sports activities. They have been consciously utilizing the marketing values inherent in sports for a long time. It was first introduced in 1928 at the Amsterdam Olympic Games, and they have continued this tradition ever since.

### 3. SUMMARY

The success of Ferencvárosi Gymnastics Club's corporate social responsibility, thanks to the popularity of athletes, demonstrates the power and interest in professional sports. Decathlon counterbalances lesser-known visibility with more complex programs, where several factors influencing success come into play. The recreational sports organizing company, Budapest Sports Office, consistently achieves charitable goals by involving recreational athletes. Food industry companies, in addition to external actions, also focus on sports and health education for their own employees. In the case of corporate social responsibility, as illustrated by the examples, sport often appears as a tool. Organizations operating in various fields can leverage the positive benefits of sports. The presented businesses have been connected to the sports sector for several years or decades, both in the business sponsorship domain and in the realm of charity. They consciously employ these tools for the purpose of enhancing reputation and brand awareness. From a societal perspective, it can be said that although these companies improve their economic results, they also have a positive impact on social processes.

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**Zvezdana Krstić**Faculty of Business Economics Bijeljina,  
University of East Sarajevo  
Bosnia and Herzegovina  
zvezdana.gavrilovic@gmail.com**Mirjana Maksimović**Faculty of Electrical Engineering, University of  
East Sarajevo, East Sarajevo  
Bosnia and Herzegovina  
mirjana.maksimovic@etf.ues.rs.ba

## **SIGNIFICANCE OF EXPLAINABLE ARTIFICIAL INTELLIGENCE (XAI) IN MARKETING**

**Abstract:** Explainable artificial intelligence (XAI) is increasingly crucial due to its extremely important role in modern marketing, as it advances predictive analytics of consumer behavior and analysis of the purchase decision-making process. This paper examines the importance of XAI in marketing, emphasizing its role in improving the effectiveness and efficiency of marketing strategies. By examining the evolution of AI in marketing and the challenges posed by opaque algorithms, this study highlights the transformative potential of XAI in bridging the gap between marketers and consumers. In addition, ethical issues related to the application of XAI are discussed, emphasizing the imperative of conscientious application in order to maintain privacy and consumer trust. Furthermore, possible directions for the use of XAI are explored, with the aim of driving marketing practices in a data-dominated era. This paper highlights the key role of XAI in shaping future trends in marketing research and its implications for businesses operating in a dynamic market environment.

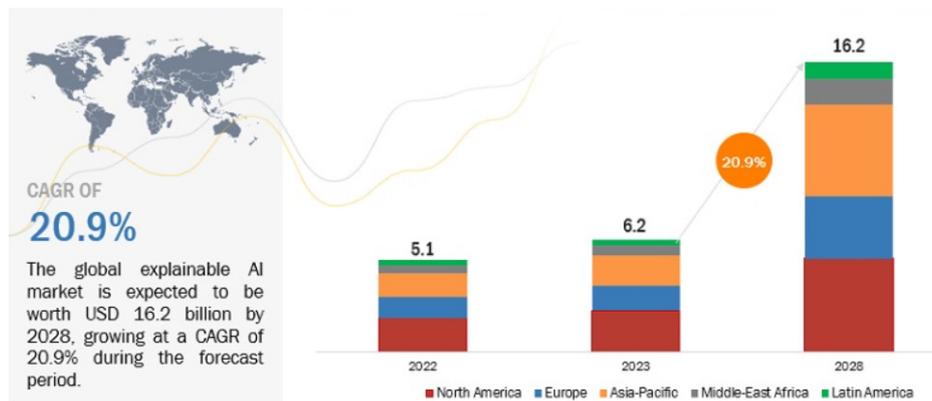
**Keywords:** Explainable Artificial Intelligence (XAI), Marketing, AI, Consumers

### **1. INTRODUCTION**

In computer science, artificial intelligence (AI) is the process of creating algorithms that can process large amounts of external data and identify patterns and correlations as well as perform tasks that are similar to those performed by human intelligence (UNECE, 2021). AI is a recent technological advancement that can provide intuitive information and data and hence facilitate more precise decision-making. As such, it has helped revolution in many industries and sectors, such as healthcare, transport, education, finances, retail, and others. Its expanding role extends to business and marketing realms whereby it is used to provide instant answers to solve problems that are pertinent and also to achieve insightful perception of consumers, putting it at the forefront of contemporary marketing tactics (Krstić and Maksimović, 2022).

AI models are often superior to conventional algorithms in terms of accuracy and performance as well. However, on some occasions, it can be very difficult to explain the result of a model. While some AI systems may not value the complexity of explaining and justifying algorithmic outputs, in the majority of cases, understanding and defense of the algorithms are compulsory, which is usually a result of legal requirements. Therefore, in industries where such consequences are widespread, interpreting AI models is especially important. Explainable AI (XAI), also known as interpretable AI or transparent AI, is the term that is used to indicate the methods in which the AI solution will be transparent. This helps to enlighten the user regarding the decision-making processes without any technical knowledge. So, XAI works to avoid the "black box" concept case, where outputs and the explanations for the algorithms are kept around unseen to talk with the rationale behind the output (Calvo Martin et al., 2023; ICT & Media, 2023).

In response to businesses' efforts to improve the transparency and understandability of AI systems, the global market for XAI has experienced significant growth. The XAI market is expected to experience a 20.9% growth, reaching a market value of \$16.2 billion by 2028, up from \$6.2 billion in 2023 (Fig. 1) (Markets & Markets, 2023). Prominent entities within the AI domain are allocating resources towards XAI research and development, concurrently with the emergence of specialty companies emphasizing explainability. The need for transparent and accountable AI systems is growing, and the XAI industry is well-positioned to meet this demand.



**Figure 1: XAI market global forecast to 2028 (USD billion)**

**Source:** Markets & Markets, 2023

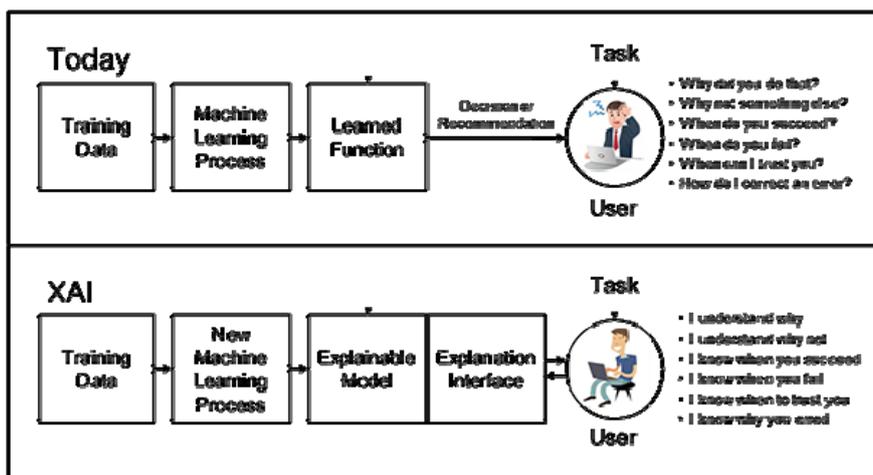
XAI will transform the marketing landscape by introducing transparency and accountability. XAI acts by explaining how AI makes up for its decisions, thus building confidence, improving personalization, reducing bias, maximizing resource allocation, guaranteeing regulatory compliance, and encouraging fruitful cooperation between marketers and AI. Also, using XAI as a tool to provide a marketing strategy to customers will result in increasing consumer engagement and trust. When marketing is undergoing evolution, XAI becomes the key thing to help companies that work on the creation of ethical and impactful advertising.

This paper will focus on the importance of XAI in marketing. The rest of the paper is arranged as follows. The second section presents the basic concepts of XAI. The role of XAI in the marketing domain is shown in the third section. The fourth section presents some of the AI and XAI tools used in consumer behavior' prediction. Ethical considerations and future trends are emphasized in section five. The last section draws conclusions.

## 2. UNDERSTANDING XAI

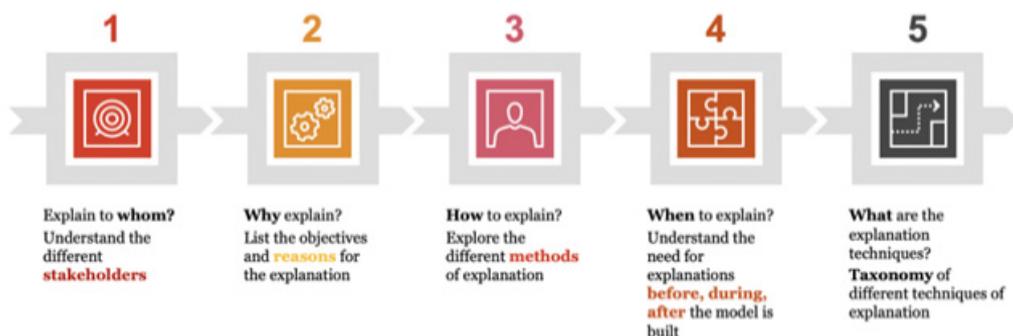
Since digital transformation provides access to a massive amount of data, industries have been completely transformed and driven to the widespread use of AI and machine learning (ML) techniques. Despite the fact that AI models are increasingly augmented with predictive power, risks still exist such as unverified bias, incomplete knowledge, and an unforeseen chance of errors. This can have the effect of throwing doubt on the credibility of these models and creating suspicion over how interpretable the results of AI algorithms are. XAI allows people to explain the operation of these algorithms including the underlying ML, neural networks, and deep learning features which improves their trust in these models. The capacity of XAI to identify challenges such as regulatory compliance, trust deficits, and impacts on society has led to an increase in the demand for technology not only from the industry but from the academia too. Therefore, regulations by a number of governments worldwide focus on the transparency and interpretability of AI systems. For example, the General Data Protection Regulation (GDPR) in Europe requires businesses to inform citizens about the AI models' results, highlighting the need to create interpretable AI models in order to comply with legal requirements. The Artificial Intelligence Act (AI Act) was introduced by the European Parliament in 2021 to regulate the use of AI within the EU and create a comprehensive regulatory framework for AI systems. This Act necessitates transparency at all stages and allows human intervention for high-risk systems across the EU and splits the AI applications into groups based on their risk level. Moreover, the European Commission issued Ethical Guidelines for Trustworthy AI in 2019, which include seven main requirements for reliable AI systems. Such guidelines pinpoint on explainability of AI models, advocate for transparency, and set the evaluation scale to detect by which criteria the compliance shall be set (Calvo Martin et al., 2023).

Organizations can have access to the basic AI decision-making processes that can be easily changed by modifying the process with the help of XAI and interpretable ML. Transparency and explainability are the core differences between XAI and AI (Saeed & Omlin, 2023). Even though AI is the term that brings to mind a myriad of technologies developed to reproduce human intelligence, conventional AI systems often hide the process by which the decisions are made. XAI involves the production of AI systems that are transparent and understandable to people, so that people can collaborate and gain trust in AI models (Fig. 2).



**Figure 2: XAI concept**  
Source: DARPA, n.d.

In AI, the concepts of interpretability and explainability are tightly connected (Vainio-Pekka et al., 2023). Explainability focuses on understanding why this or that decision or prediction was given about a given instance, whereas interpretability deals with understanding why the entire model makes decisions or predictions. In the context of XAI, five pivotal questions arise: — Whom to explain? Why explain? When to explain? How to explain? What is the explanation? (Fig. 3) (Swiss Cognitive, 2021).



**Figure 3: Five key questions to answer when building XAI**  
Source: Swiss Cognitive, 2021.

For any organization is important to take into consideration the principles of explainability and interpretability of XAI systems in the process design and operation improvement. The XAI framework consists of four elements that aid in the integration of explainability and interpretability (Calvo Martin et al., 2023):

- *Interpretability strategies for AI models:* Three interpretability components form an XAI framework's foundation: bias detection, ongoing model monitoring, and explanation for the model's design and results.
- *Alignment with model risk management (MRM) protocols:* The interpretability of ML models influences all stages of their lifecycle, including MRM. It becomes essential to assess the audit framework, as well as the policies and practices that relate to the model development, monitoring, validation, deployment, and usage, so the integration of XAI components may happen most appropriately.
- *Support from Information technology (IT) infrastructure:* The use of expert IT solutions for designing the features of ML models to be interpretable is a must-have. This comprises data analytics systems, application programming interfaces (APIs), security measures implementations, auditing tools, and the setting of protocols and standards assuring an observance of quality specifications and explainability regulations.
- *Human interaction:* In order to ensure the implementation of XAI it is crucial to consider the human factor. This involves recruiting and retaining staff, implementing training programs, fostering a culture that values understandable ML models, and changing management plans.

The XAI's capabilities are (Holistic SEO, 2023):

- *Model interpretation:* XAI provides insight into AI models' inner mechanisms by evaluating feature influence, clarifying impact, and identifying patterns and decisions.
- *Local explanations:* XAI enables the model users to see inside specific forecasts that a certain set of variables affected the results and also provides a reasoning-based decision-making justification in particular situations.

- *Global explanations:* XAI aids in obtaining deep insights into model behavior that is able to explain not only specific decisions but also patterns and rules that govern the model's behavior in general.
- *Rule extraction:* Part of the complexity of some AI models is captured using explanations in the form of rules or decision trees that humans can understand.
- *Visualization:* XAI utilizes graphics to exemplify decision-making processes or feature importance.
- *Counterfactual explanations:* XAI works in a direction to give users insight into the variables that are driving the results of AI model decisions, therefore it generates other hypotheses that explain specific outputs.
- *Estimating uncertainty:* XAI supplies probabilities of possible situations and the level of uncertainty of AI predictions allowing us to measure prediction uncertainty. This is the way to determine whether AI system outputs are acceptable or not for the users.

## 2.1. Benefits and challenges of XAI

The advantages of XAI include (Holistic SEO, 2023; Verma & Ainapur, 2021):

- *Enhanced Transparency:* XAI guarantees that the AI decisions are transparent, providing users with clear explanations that enable them to understand the reasons for the outcomes and what aspects a particular solution is based on.
- *Accountability and Responsibility:* AI models cannot be 100% correct, which implies the need to have someone who would handle mistakes themselves and have others be accountable for mistakes. This will optimize the system as a whole.
- *Minimizing the Effect of Model Biasing:* XAI can help achieve this by identifying the factors of bias in the decision-making processes that exhibit biased behavior and then facilitating corrective actions to establish unbiased AI systems.
- *Reducing the Cost of Mistakes:* Incorrect anticipation causes serious harm to decision-sensitive fields. Controlling the result outcomes and identifying the core of the cause improves the model.
- *Model Debugging and Improvement:* XAI techniques afford the data scientist the ability to look within the existing model and possess the knowledge of influence factors in order for them to identify and fix flaws in AI. This in turn improves the performance and reliability of the model.
- *Promoted Trust and Acceptance:* XAI enables users to understand the inner workings of AI and the decision-making process, boosting their perceptions of insight and recommendations coming out from AI, therefore increasing user acceptance.
- *Regulatory Compliance:* XAI makes companies comply with legal requirements that obligate the explanations in AI-made decisions. This leads to the proper regulation in sectors where there is the application of ethical and legal norms.
- *User Empowerment:* Through XAI, people will have more control over how AI technology can assist them in their decision-making processes, by gaining an insight into why the recommended actions or judgments were influenced.

Challenges related to XAI are (Adadi & Berrada, 2018; Kenfront, 2023; Saeed & Omlin, 2023):

- *Absence of a common definition of explainability:* The development and assessment of explanation techniques are extremely complicated because of a lack of a common definition of explainability.
- *Accuracy-explainability compromise:* Complex models are able to provide accuracy at the cost of interpretability, while simpler models offer feasible explanations but suffer from accuracy drawbacks.
- *Privacy:* Revealing the model's inner workings might result in sensitive data leaks.
- *Computational costs:* In order to fully understand the explanations provided by the ML models, additional computations are needed which implies that using XAI in real-world scenarios can be challenging.
- *Absence of data:* For the model to explain its working correctly, setting it with data available for its training is necessary. However, providing such information to the public could not be practicable because it can be mostly proprietary or confidential.
- *Difficulties with Tools:* AI models are described through various tools. Some XAI tools are complex and hard to use and are intended for specific model types or datasets. These tools also have problems with coverage and scalability.

## 3. THE ROLE OF XAI IN MARKETING

In the present fast-moving business society, efficient marketing strategies are one of the main factors that determine whether a company becomes a success or failure. In the marketing domain, traditional approaches have successfully worked before, but with the ongoing changes in customer behavior and trends, creativity is required. The answer is XAI. Unlike a black box which is typically the way traditional AI works, XAI endeavors to bridge the gap between complex units of computations and human understanding. Its critical task is to increase transparency, and that people can follow and understand why AI makes certain decisions. Hence, XAI becomes a game-changer for the marketer as it

provides the needed transparency to trace through complex AI algorithms. The value of XAI is that it can visualize and interpret the components of the marketing campaigns thereby enabling businesses to enhance their performance, forecast consumer trends, make informed marketing decisions, and maintain positive relationships with their customers. XAI has the power to revolutionize marketing strategies by facilitating faster and more precise data analysis and offering instantaneous insights into customer preferences. Hence, XAI reshapes marketing strategies by enabling marketers to navigate AI-driven campaigns with transparency and accuracy. This makes it possible to create targeted advertisement campaigns that are tailored to the needs and preferences of customers. With transparent operations, products, and services, transparent businesses gradually gain more customer loyalty, advocacy, and sales. Transparency is thus recognized as a critical component in building consumer trust (Abbas, 2023; Voleti, 2023).

The main advantages of XAI in marketing can be summarized as follows (Mishra, 2023; Abbas, 2023; Clark, 2023):

- *Effective resource allocation:* Many marketing companies experience difficulties in the process of allocating resources efficiently. XAI can support them in achieving this goal, hence resulting in the highest return on investment (ROI).
- *Increased customer trust:* Through XAI, marketers are enabled to provide customer-oriented targeting for products they offer, which above all builds up trust toward them and promotes relationships between customers and companies.
- *Optimized marketing campaigns:* XAI helps marketers enhance the efficiency of their marketing activities by giving feedback on their offerings and experiences, which, in turn, allows them to carry out more productive branding tests.
- *Adherence to legislation:* As data privacy regulations are oftentimes changing, marketers have to make sure to keep up with new guidelines.
- *Improving AI Insight Comprehensibility:* A complicated task for marketers with limited knowledge of technology might be to make sense of the AI-generated findings. This is the reason why an effective way of presenting the outcome must be a format that is easily understood and comprehended by the readers (i.e., effective explanations, summaries, and visualizations).
- *Optimizing Personalization:* XAI plays a key role in the growth of personalized marketing. XAI allows marketers to refine their strategies by explaining the reasons for the recommendation of products, targeting ads, and content.
- *Mitigating Bias and Discrimination:* With their campaigns, which may have resulted in data stereotyping due to ML models, marketers may unintentionally create unfair treatment of particular groups. XAI enables marketers to discover how AI algorithms make their decisions which results in exposing and addressing these biases.
- *Promoting Collaboration Between Humans and AI:* XAI facilitates collaboration between marketers (humans) and AI systems. In this collaboration, human creativity, intuition, and domain expertise are added to AI abilities.

While there are enormous benefits that come with XAI, XAI in the marketing domain faces several challenges (Mishra, 2023; Telligent, 2024):

- *Technical Complexity:* The biggest obstacle to XAI implementation in marketing is the complicated technicality that comes with the creation and utilization of transparent AI algorithms. To design XAI models for a particular domain, such as marketing, cooperation between data science, ML engineering, and AI personnel is mandatory. Only by possessing adequate knowledge and resources, marketers can successfully deal with such challenges and implement XAI to achieve a variety of business objectives.
- *Integration with Current Systems:* Including XAI within existing marketing workflows and systems can be quite challenging as it requires integration with different tools and technologies.
- *Interpretability vs. Performance Trade-off:* Achieving a compromise between the AI models' performance on one side and the transparency and interpretability on the other side is another challenging task. Although complex models have less transparency, high-degree interpretable models may produce low precision.
- *Data Quality and Bias:* XAI models are called for the data in decision-making; consequently, biased or poor-quality data may produce biased marketing results.
- *Privacy Concerns:* Using personal data in marketing campaigns that include XAI, raises privacy and ethical concerns.
- *Regulatory Compliance:* The ever-changing regulations require marketers to stay informed and compliant.
- *Education and Training:* Many marketers do not possess the knowledge and skills necessary to understand and utilize the recent technological advancements, such as XAI, in their campaigns. Hence, for XAI to be fully utilized in marketing, marketers need to attend seminars, courses, and trainings to gain the required skills and knowledge.

Based on performed research, it is obvious that XAI has great potential for use in the marketing domain, particularly for consumer segmentation, predictive targeting, ad targeting, optimization, content creation, etc. Having in mind that the use of XAI in marketing will grow, companies must invest in this domain and work on overcoming challenges that stand in the way of XAI's widespread use in marketing.

## 4. AI TOOLS FOR PREDICTING CONSUMERS' BEHAVIOR

Predictive analytics is defined as the use of large data sets and the application of algorithms to predict consumer preferences. With this proactive approach, companies get an opportunity to more accurately direct their strategies and hence ensure the right mix of promotional activities and engagement with their consumers. Predictive analytics is based on historical data and provides companies with better business decisions in terms of basing their business principles on implementing a proactive strategy instead of a reactive marketing strategy (GG Insights, 2024). Predictive analytics and AI analytics automate data analysis to make predictions using AI tools and algorithms. When AI analytics automate data collection and processing, companies improve the decision-making process that determines a company's business success. Some of the tools and platforms mentioned that can help carry out the prediction of consumer behavior based on AI are (Dowling, 2023): *Amazon SageMaker*, *IBM Watson*, *Microsoft Azure Machine Learning*, *DataRobot*, *H2O.ai*, *Salesforce Einstein*, *Python*, and *R programming*. Other considerations required to be taken into account while choosing a tool or platform should reflect an individual firm's requirements and scalability, as well as integration and ease of use. The following AI tools for researching consumer needs and demands are predicted to be the most important in 2024 (Oranie, 2024):

- *Amazon Polly Analytics* - allows users to convert text to speech according to their preferences.
- *Google Cloud AutoML Tables* - with the help of engineering automation and adequate customization methods, it encourages the development of ML models.
- *SurveyMonkey* - contains AI-powered survey tools used to collect and analyze consumer data.
- *Medallia Experience Cloud* - with the help of this tool, companies collect, analyze, and respond to the data they receive from consumers through various customer contact points.
- *Qualtrics CustomerXM* - enhances customer experience management. Thanks to AI, more effective analysis is acquired to keep the customers engaged and personalize experiences.
- *SAS Customer Intelligence* - ML and AI together gather insights on customer data for the purposes of promoting higher customer engagement and loyalty.
- *Adobe Analytics* – uses AI to analyze consumer behavior and provide a personalized customer experience using differentiated digital channels.
- *Hootsuite Insights* - provides AI-powered social media analysis to better understand consumers and increase their engagement.
- *Reltio Customer 360* – thanks to this tool, the management of consumer data is facilitated, which is supported by appropriate AI analytics, all with the aim of offering end consumers personalized experiences on all digital channels.
- *Sprinklr Experience Cloud* - simplifies the management of social networks through appropriate solutions based on AI, which consequently results in offering solutions for better understanding and interaction with end users.

### 4.1. Types of XAI Tools

XAI tools are software and systems that allow human insight into the decision-making process of algorithms developed based on AI. Their main mission is to create more reliable and trustworthy AI systems in this respect. On the basis of recommendations from some open-source XAI tools and frameworks (Maaian, 2024; Dvivedi et al., 2023), some instruments are put forward:

- *Explainable AI Toolkit (XAITK)*: This should be an all-around toolkit mainly targeting the comprehension of ML models by both researchers and developers. Features such as the After Action Review for AI (AARfAI) for systematic analysis of AI reasoning processes, the Bayesian Teaching for XAI for human-centered frameworks, frameworks for creating counterfactual explanations, datasets with multimodal explanations, misinformation detection tools, and techniques for creating psychological models and natural language explanations and psychological models for a range of applications are all included.
- *Shapley Additive Explanations (SHAP)*: It is an ML and AI technique with a focus on explaining the outputs of the model, with particular emphasis on XAI. The Shapley values determine the average marginal contributions of the features and identify the possible combinations of 'coalitions' a feature can take part in, explaining complex models involving many features, both discrete and continuous variables.
- *Local Interpretable Model-agnostic Explanations (LIME)*: It provides simple explanations that an observer can understand for predictions made by complex models. Its key features include compatibility with any ML model, no matter its complexity; focusing on explaining individual predictions, while ensuring relevance; generation of interpretable proxy models that can be substituted for complex models; quantitative measures of feature impact through the display of scores, called feature importance scores; and generation of configuration and customization options for the user to modify things like the sampling strategy and surrogate model selection.
- *"Explain Like I'm 5" (ELI5)*: It is a library covering everything needed from ML and visualization to debugging. It enables to get visualization and analysis of all model predictions. An API enables one to know

and debug the behavior of models, built-in support for almost every popular framework and package—in one place.

- *InterpretML*: Built upon the interpretability techniques incorporated into state-of-the-art ML, InterpretML is a novel open-source package. The key features include the integration of state-of-the-art ML interpretability techniques, exploring individual predictions to explain the results of specific decisions, user-friendliness by an open, unified API set, a wide range of explainers and techniques with interactive visuals for flexibility and customizability, and comprehensive capabilities for exploring model attributes such as performance, global, and local features.

When discussing XAI, a comprehensive understanding of the goals, careful consideration of the type of ML model, performance and scalability requirements, visualization and reporting capabilities, user-friendliness, and community support are all crucial components that have to be considered for every AI system (Maayan, 2024).

## 5. ETHICAL CONSIDERATIONS AND FUTURE TRENDS

Predictive analytics has great benefits for marketing, but best practices should be followed, considering ethical implications. Protection of the customers' information has to be first and foremost because privacy issues arise when marketers use predictive algorithms and personal data. To alleviate the concerns about privacy, marketers must assure consent and transparency in the procedures of data collection and usage. Providing secure solutions is the only way to ensure the privacy of the customers' data. Moreover, predictive analytics must be managed carefully and with no underlying discrimination practices, making sure the algorithms and models don't reinforce prejudices or stereotypes. Consumers develop higher trust if predictive analytics is used clearly and transparently, and biases are reduced through regular audits, algorithm evaluations, etc. Marketing researchers also should be ready for and interested in mitigating any adverse effects related to XAI and, at the same time, equipped with the capabilities of monitoring and tracking all decisions made via XAI. While customers have control over their data and messages to which marketing is applied, marketers must respect customer autonomy. It is important to comply with all of the laws, regulations, and consumer protection laws as well as data protection laws, so marketers can ethically use XAI in marketing. It is of immense importance to stay updated about changing regulations since marketing is changing all the time. Predictive analytics revolutionizes marketing through insights into consumer behavior, campaign optimization, and fact-based decision-making. Companies that implement this ethically and responsibly will retain their competitive edge in an ever-changing marketing scene (GG Insights, 2024; Vainio-Pekka et al., 2023).

Predictive analytics is hence very likely to boost the strategies in marketing with XAI, especially as the data-driven marketing era advances. It is then expected that XAI will result in enhanced creativity, real-time decision-making, hyper-personalized customer experiences, and better personalization. Moreover, it will enhance further prospects of ongoing learning and development, combining with emerging technologies, and keeping moral and open marketing practices. Hence, if fully established, XAI can change marketing completely to bring in a new level of personalization, scalability, and efficacy from the rapidly changing data-driven marketing area to create campaigns with higher success rates, stronger coherence, and more ethical practices.

## 6. CONCLUSION

Improved predictive capabilities, thanks to AI techniques, have found use in most industries. This, however, emphasizes that it is very important to explain AI model outputs, and XAI is very much needed, more so in sensitive industries such as energy, healthcare, finance, and security. XAI's goal is to increase the interpretability of AI models through very innovative methods.

The widespread use of AI in marketing has turned customer interaction into a new paradigm. XAI enables campaigns tailored to each person's preferences and behaviors. Through correct targeting and quick delivery of messaging, XAI will contribute significantly to enhanced customer satisfaction and loyalty, which leads to customer retention and revenue growth.

Therefore, XAI can revolutionize marketing strategies by enabling data-driven decision-making and improving the customer experience. It helps in fostering trustworthiness and reliability through interpretability and explainability features, providing clarity on decision processes. XAI is predicted to change the industry landscape in the future when it becomes more popular and gets used widely within marketing, where data analytics' undiscovered value unleashes. Therefore, marketers should start making use of XAI as soon as they can if they want to prosper in the AI era.

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**Golikova Victoria**  
 Higher School of Economics  
 Moscow, Russian Federation  
 e-mail victoria@hse.ru

**Kuznetsov Boris**  
 Higher School of Economics  
 Moscow, Russian Federation  
 e-mail

## **RECONFIGURATION OF COOPERATION TIES OF RUSSIAN MANUFACTURING FIRMS UNDER ECONOMIC SANCTIONS**

**Abstract:** A This paper is focused on one important direct consequence of economic sanctions introduced in 2022: namely, on the necessity to change the suppliers of raw materials, components and equipment in Russian manufacturing firms that historically had long-term cooperation ties with the partners from Europe. The main goal of the paper is to investigate the immediate response to the break of contracts and cooperation agreements, namely, (a) what firm-specific features are associated with the managerial decision to change the suppliers, (b) what is the scale of import substitution and (c) what is the geographical structure of new cooperation partners.

This study is based on the results of the representative survey of 1860 Russian manufacturing firms. It was conducted with CEOs in 2022 and covers firms with more than 10 employees. The survey reports the information on a variety of firm characteristics such as size, age, location, ownership, international trade, cooperation ties, investment and innovation, etc.

We provide the empirical evidence that sanctions shock of 2022 turned out to be extremely painful for the current supply structure and forced enterprises to look for solution to compensate for gaps in cooperation chains. We tested several hypotheses to identify those characteristics of the company that are associated with the reconfiguration of suppliers of raw materials/materials, parts/components or technological equipment. In the econometric analysis, we use probit regression controlling for firm size measured as number of employees, industry heterogeneity and regional territorial effects. Our finding confirmed that it was systematic importers who turned out to be the most vulnerable and affected group because of the imposition of sanctions, and it was this group that began to actively seek a replacement for contractors who had cancelled cooperation. The most technologically advanced firms and active innovators were found to be in the group of those who immediately replaced suppliers in the first months after the imposition of sanctions. Another finding is a significant positive role of the supply chain digitalization.

We have shown that it was European suppliers that Russian firms most often changed in 2022: 80% of firms that changed foreign suppliers indicated Europe as the region of previous supplies. At the same time, in 2/3 of cases, the reason for the replacement was the unilateral refusal of the partner from further deliveries – i.e. the replacement was forced. This was only partially offset by switching to Russian suppliers, although it should be noted that the share of such replacements (from a foreign supplier to a domestic one) turned out to be higher than expected. According to indirect data, enterprises managed to find an alternative within Russia for 30-40% of European partners but most of the changes in the network of foreign suppliers were not related to import substitution as significant part of the imports have switched to China.

Keywords: manufacturing firms, sanctions, supply chains, Russia

## **INTRODUCTION**

The developed and flexible system of firms' supply-chains is the important and immanent part of the market economy and reflects the interplay between the necessity to improve firm's competitiveness by looking for suppliers with more attractive prices/quality and the need to low down transactions costs and risks by establishing sustainable cooperation with long-term suppliers. The globalization trends in recent decades resulted in development of more complicated

supply chains and the growth of both the share of international contracts and the use of imported intermediate goods and equipment.

While Russian manufacturing firms have been following those general trends, it should be noted that cooperation networks common to market economies started to form in Russia rather late – mostly in the 2000-s. In the soviet-type planned economy the supply chains were fixed by the state system and enterprises has no choice in picking the supplier or customer. During the transformation crisis of the 90-s that followed the market reforms the previous established links between firms collapsed due to the bankruptcy of many firms and the appearance of new trade barriers between the Eastern European countries (former SEV - Council for Mutual Economic Assistance) and Commonwealth of Independent States (CIS) countries - former republics of the Soviet Union. During the transition period (1992-1998) Russian manufacturing output declined by 60%. The decline was much higher in such industries as investment machinery, electronics, military production and in high-tech sectors in general, some subindustries such as machine tools production have constricted 20 times and more.

The new, market oriented, cooperation networks started to form in Russian manufacturing during the recovery growth of 1999-2008 when the Russian economy benefited from high world energy prices and demonstrated the annual growth rates of about 7%. The manufacturing production almost doubled in those 10 years. The growing production needed new investments and the increased supply of intermediate goods. Those needs only partly could be satisfied by the growth of domestic production and it was natural for Russian firms to use import as a source of the growth. It should be noted that Russian manufacturing firms at the time were mostly focused on the increasing their shares at the domestic markets and to less extent on the markets of CIS countries while the main source of export revenues of Russia came from the energy export to Europe (due to existing export infrastructure). The newly formed global value chains for Russian enterprises by 2009 typically looked like this: importing complicated intermediates and equipment from Europe and selling finished goods to domestic clients of CIS countries. The dependence on import equipment were particular high: according to surveys data by 2009 approximately 39.9% of medium and large manufacturing firms had large investments in machinery, and among them, 91.4% had reported purchases of imported equipment (Kuznetsov et al. 2011). The economic shock of 2008-2009 was not prolonged and had no serious consequences for the supply chains of Russian manufacturing firms. The growth rates though after the initial recovery slowed down and by the end of 2013 in manufacturing industry they were close to zero. The supply networks continued to be oriented to Europe though there were a slow evolution towards higher role of suppliers from Asia (mostly from China).

The next shock to the established cooperation and supply links could have been (but actually was not) the economic crisis of 2014 combined with several waves the western sanctions introduced after the annexation of Crimea region (“reunification of Crimea and Russia” in Russian interpretation). The risks to international supply chains have been one of the most often mentioned expected negative consequences of sanctions by CEOs of Russian manufacturing firms: more than 20% of firms regardless of their size were expecting problems in this sphere. (Golikova &Kuznetsov 2017). However, those risks have not actually come true. The survey of firms conducted 4 years later in 2018 demonstrated no significant changes in neither volumes nor directions of import of intermediates or equipment. European countries continued to be the major counterparts of Russian manufacturing as a source of raw materials, details and components, technological equipment.

In this paper we shall try to analyze the first reaction of Russian manufacturing enterprises’ supply chains to the much more severe shocks of 2022 sanctions. We presume that (as it commonly happens) the reaction was heterogeneous and we are interested in finding which features of firms facilitate the quick adjustment to sanctions in terms of re-configuring their supply network, in particular – the decisions to change domestic or foreign supplier in 2022.

## **1. SUPPLY CHAINS MANAGEMENT IN THE TIMES OF ECONOMIC SANCTIONS: LITERATURE REVIEW**

Recent massive reconfiguration of global and local supply chains is an evident result of pandemic Covid-19 and geopolitical tensions of Russia-Ukraine conflict. While the first event has already been well covered empirically in the literature (Ivanov,&Dolgui, 2020; Lafrogne-Joussier, Martin,& Mejean, 2023; Vega, Arvidsson, &Saïah, 2023; Browning et al., 2023; Bednarski, Roscoe, Blome, &Schleper, 2023; Queiroz, Ivanov,Dolgui, &Fosso, 2022) , the second one is at the very early stage of exploration due to the novelty of the event, scarce reliable empirical and statistical data on micro-level. Not surprising, that most recent literature reviews on supply chains reconfiguration (Al Naimi, Faisal, Sobh, R., &Bin, 2022; Bednarski, Roscoe, Blome, &Schleper, 2023) do not cover yet this “hot topic”.

Our paper refers to the stream of literature on the effects of sanctions’ shocks and adjustment strategies that companies implement to provide the resilience of business in the turbulent times. The focus of the relevant studies on micro-level is either on companies from countries – sanctions’ senders, mainly from EU countries (Crozet, Hinz, Stammann,&Wanner, 2021; Brasili,&Harasztosi, 2023; Aksoy, Baur, Flach,&Javorcik, 2022; Lastauskas, Proškutė,& Žaldokas, 2023) or on companies from target states – Iran, Zimbabwe, China and Russia (Yang, Askari, Forrer,& Teegen., 2004; Cheratian, Goltabar,& Farzanegan,2023; Ghasseminejad, & Jahan-Parvar, 2021; Sun et al., 2022; Ahn, & Ludema, 2020; Golikova.& Kuznetsov, 2017; Nigmatullina, 2021; Meyer, Fang, Panibratov, Peng, &Gaur, 2023; Miromanova, 2023) .

Strategic adaptation to external shocks and subsequent restructuring of business processes takes from several months to several years and in some cases can lead to a complete change of the business model (Morgan, Anokhin, Ofstein, & Friske, 2020), including new configuration of supply chains (Ollagnier, Timmermans, Brueckner, 2020).

One of the most acute problems after the introduction of sanctions restrictions is uncertainty and risks in supply chains due to changes in geopolitical conditions, and a spill over effect that goes beyond direct targets via several avenues: direct relationships, access to foreign markets, access to technology and logistics failure (Shalpegin, Kumar, & Browning, 2023). Non-targeted firms in the same supply chain that targeted firms suffer from contagion effect and suffer from reduced sales and increased costs of products (Sun, Makosa, Yang, Darlington, Yin, & Jachi, 2022).

Recent review of studies in manufacturing industry identifies the research gap and importance of analysis how manufacturers can make in-time response to mitigate the risks of supply chain vulnerability by the reconfiguration of supply chain. According to Roscoe et al. (2022) it includes the choice of suppliers and their location, storage facilities and method of transporting goods. Management decisions deal with diversification of sourcing locations, monitoring of new regulations and compliance, analysis of possibility to shorten supply chains and organize new logistics aimed to improve agility to react to geopolitical concerns (Kanike, 2023; Shalpegin, Kumar, & Browning, 2023). Roscoe et al. (2022) found that these decisions are constrained by perceptions of institutional pressure and potential disruption risk and take into consideration relative mobility of suppliers and supply chain assets.

The adaptation of firms to the sanctions regime in Russian case requires an immediate response to shocks that can lead to a shutdown of the production process and a subsequent reassessment of risks and opportunities that could be realized in the medium term. Key success factors in mitigating strategies are learning capability and agility (Müller, Hoberg, & Fransoo, 2023) and collaboration with supply network partners (Azadegan, & Dooley, 2021).

Empirical evidence on the significance of supply problems for Russian manufacturing enterprises is rather scarce. The most close to our research are two waves of surveys of organized by the Institute of Economic Policy (IEP) in 2022 and 2023 (Chugunov, 2023; Russian companies have revealed, 2023). The sample of the survey is about 1000 enterprises. The results of these two waves gives an opportunity to compare the respondents' estimates immediately after the introduction of the first packages of sanctions introduced in 2022 that indicates an assessment of potential risks and threats and the real effects 10 months later after some adjustment measures on the firm level were undertaken. Empirical evidence suggest that during this time frame a small progress in substitution of foreign suppliers by local producers was done. At the same time, near-shoring in "friendly" states brought some benefits as the share of firms with complains about lack of alternative suppliers in these countries decreased by 10 p.p. Perception of problems with maintenance of the imported equipment also reveals a positive trend. The forced change of suppliers of intermediaries and equipment, as well as an increase in logistics costs, which underwent drastic changes over the year due to a reduction in supplies from Europe and reorientation to supplies from China were among the factors that affected an increase in costs.

European firms also had to adjust to sanctions' regime and incorporate changes in supply strategy. According to the representative survey of the IFO Institute, in Germany in 2022 87% of firms had taken some measures to ensure the resilience and robustness of supplies (or a set of measures), among which, most often - in 68% of cases, firms indicated an increase in stocks and diversification of suppliers (65%). More than half of the firms noted more thorough monitoring of supply chains (54%), redistribution of orders between existing suppliers (38%), while increased vertical integration (insourcing) was much less popular measure (Aksoy, Baur, Flach, & Javorcik, 2022).

Large scale survey of European Investment Bank which covers all EU countries in its 7<sup>th</sup> wave revealed that that more than half of firms associate problems with global logistics and access to materials and services with the COVID-19 pandemic and military events in Ukraine (Brasili, & Harasztosi, 2023). Active adjustment measures include two main strategies: diversification (increase of supplying partners' number) or focus on domestic markets and suppliers. Econometric estimations revealed heterogeneous response to supply shocks. Younger, larger and more productive firms as well as innovative and using digital technologies were more likely to implement active reconfiguration of supply chains and more often chose diversification than focusing on domestic markets and suppliers. In general, the authors of the report emphasize that management of supply chains has become much more complicated and risky. To avoid or lessen the risks companies have to use stockpiling or increase the number of potential suppliers (and their locations) on the local markets, while diversification in foreign markets is not available to every company. This, according to the researchers, may lead to an increase in the efficiency gap between leading and lagging firms.

In general, the economic consequences of economic sanctions for supply chain participants are harmful both for the firms from countries – senders and targets. According to Chinese researchers (Jin, Meng, Wan, & Wang, 2023) besides rising trade costs the probability of supply chain disruption between them increase by 4% and, correspondingly, reduce the probability of establishing new ties by 8.5% as a result of increased policy uncertainty, decline of political trust and negative public sentiments. The discussion on the main trends in reconfiguration of supply chains - a shift from a former trend on globalization to "near-shoring" or "friend-shoring" is going on now (Gong, Hassink, Foster, Hess, & Garretsen, 2022; Javorcik, Kitzmueller, Schweiger, Yıldırım, 2022; Alfaro, & Chor, 2023) and need more empirical evidence from developed and transition economies.

## 2. DATA AND DESCRIPTIVE ANALYSIS

The empirical database we use was drawn from the survey of 1860 Russian manufacturing firms with more than 10 employees. The survey was conducted by a surveying company in 70 regions across Russia in August-November 2022. Face-to-face interviews were conducted with the top managers (CEOs and CFOs). The random structured sample has been constructed to be representative in terms of distribution by industry and size of the firm, although it is not representative for Russian regions. In this paper if not reported otherwise we re-weight our results to be representative for general population of firms. For comparisons we also use the results of similar surveys conducted in 2014 and 2018<sup>1</sup>.

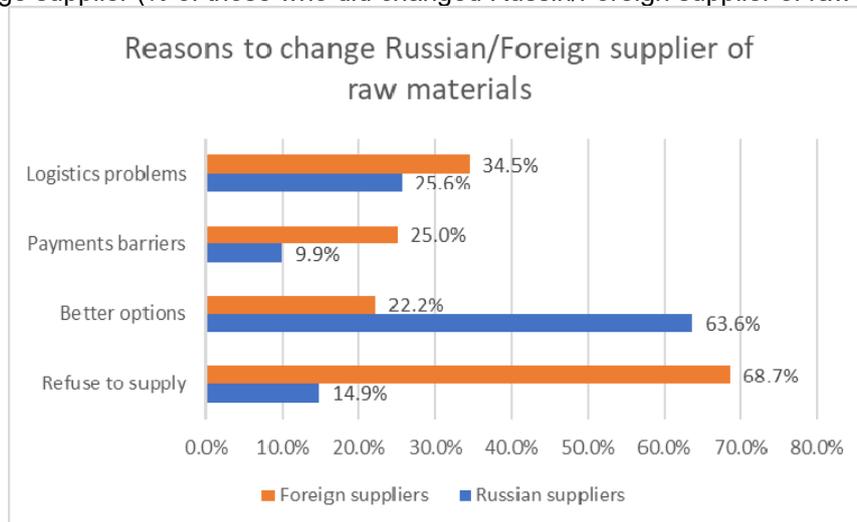
As we have mentioned by the end of 2010s Russian firms has created a developed and more or less efficient cooperation networks typical for many developing countries: large-scale import of technologies and equipment as well as the import of raw materials, details and components. To some extent, it is a model similar to China but opposite to Chinese case, Russian model was oriented mostly on domestic markets and neighbor countries. Due to the growth of specialization and the increase outsourcing the supply chains became more complicated that is reflected in the growing average number of suppliers. The date of 2018 survey showed the average number of suppliers for a single firm of about 30 and in 2022 it was 44. Evidently this figure variates pending on the size of firms - from 35 for small firms to 112 for large firms - and the industry (type of economic activity). Naturally, firms are always in search for better opportunities and new suppliers though they mostly prefer long-term relationships keeping the “core supply network”: for about 2/3 of suppliers the relationships last for 5 years or more. And this share varies little by size groups or industries.

The sanction shock of 2022 became the grave blow to the established cooperation networks of firms and made it necessary to intensify the search for new suppliers: about 25% of firms has changed suppliers in 2022.

The external nature of supply chains shock of 2022 can be demonstrated by the fact that changes in the pool of foreign suppliers happened twice more often than in the pool of Russian suppliers. The impact of sanctions on the supply chains is evident if we compare the reported reasons for changing Russian or foreign suppliers (Fig.1 and Fig.2).

While the change of domestic supplier is mostly driven by finding better options (price/quality), the main reason to change foreign supplier is the broken contracts and refuse to continue supplies. Nevertheless, problems with payments and logistics were important reasons to change not only foreign but Russian suppliers as well. It is important to note that changes in the pool of suppliers of both domestic and foreign has a definite geographical dimension. The change of foreign supplier to the Russian one are not often. In most cases we see the switch of import from “unfriendly” countries to other countries (mostly to China). Figure 3 demonstrates the sharp decline in the share of imported intermediate goods from Europe and corresponding increase of China as a source of such import.

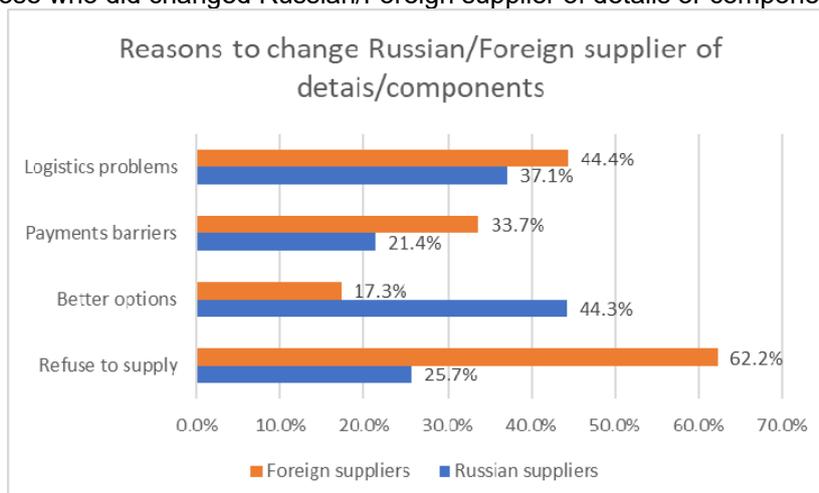
**Figure 1.** The share of respondents reporting different reasons for the decision to change supplier (% of those who did changed Russian/Foreign supplier of raw materials)



Source: Survey data, unweighted

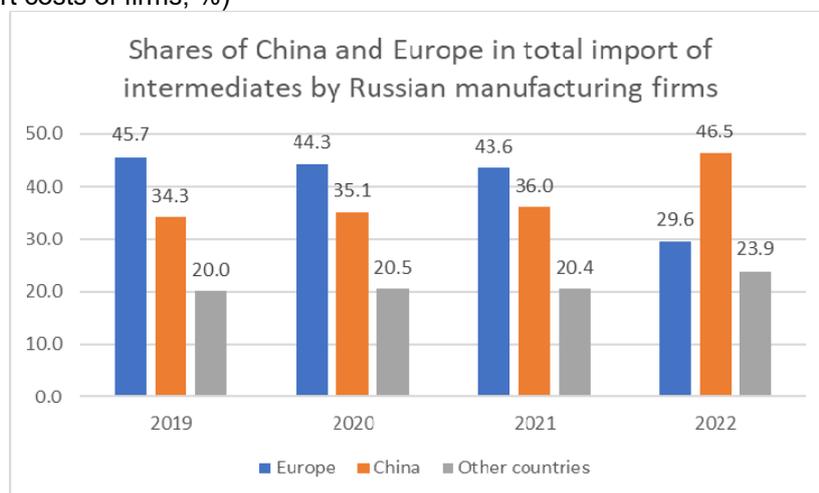
<sup>1</sup> More details concerning the surveys can be found at <https://iims.hse.ru/rfge/>.

**Figure 2.** The share of respondents reporting different reasons for the decision to change supplier (% of those who did changed Russian/Foreign supplier of details or components)



Source: Survey data, unweighted

**Figure 3.** The dynamics of import of intermediates from China and Europe (share of import in total intermediates import costs of firms, %)



Source: Survey data

### 3. METHODOLOGY

Basing on the literature review and our descriptive analysis we shall verify the following hypotheses:

H1. Firms involved into global value chains (i.e. regular two-way traders) and more broadly, in foreign trade, i.e. regular importers and exporters have higher probability to be damaged by sanctions and, thus, are more active in changing suppliers.

H2. The cooperation networks of firms that established strategic partnerships with domestic and foreign partners before 2020 are more sustainable other and firms with such partnerships are less likely to change their suppliers.

H3. The more competitive firms – active in innovations and in using digital technologies - are more active in adjusting their supply chains as they are better informed and have better opportunity for finding an alternative supplier.

We are estimating probit models to assess the determinants that affect the probability for a firm to change their local or foreign supplier. We should stress that as our survey data covers the period of September-November 2022 we can only estimate the “quick response” to the 2022 sanctions shock, i.e. we cannot catch the fact of the changes in supply chains if they happen at the later day.

We include three group of factors into the analysis: (1) involvement into global trade; (2) the development of a firm’s cooperation network; (3) the quality of management of supply chains.

The structure of the model is as follows:

$$Pr(\text{Change of suppliers}) = a1(\text{Globalization indicators}) + a2(\text{Partnership network}) + a3(\text{Competitiveness indicators}) + a4(\text{individual firm level controls}) + a5(\text{Sectoral controls}) + \varepsilon$$

The model is estimated separately for change of suppliers of raw materials, of details and components and for changes of equipment suppliers.

## Measures

For globalization indicator we use categorical variable where (1) is the group of two-way traders, i.e. firms with regular export activity in 2019-2021 and regular activity in importing raw materials/details and components/equipment in the same period; (2) firms involved only in import activity but selling exclusively to domestic Russian market; (3) exporting regularly without using imported inputs; (4) firms not involved in international trade. The group (4) is the reference category in our regressions.

We further presume that established partnership relations make network more stable and decrease the probability of changing suppliers. We shall estimate the impact of both domestic strategic partnerships and international partnerships.

We shall use regular product innovation activity and the usage of Suppliers Chains Management (SCM) digital technology as proxy indicators of more technologically advanced and more competitive firms.

The block of firm level controls includes the categorical variable of firm size: small firms (below 100 employees) as a reference category, medium firms (100-249 employees) and large firms (above 500 employees), the logarithm of overall number of suppliers and product specialization of the firm (the logarithm of the share of main product in the total revenue). Sectoral differences are controlled by Pavitt taxonomy of industries where the group of supplier dominated industries is a reference category. We also use a dummy variable of CEO being a controlling owner as it may be relevant for the perception of sanctions' risks. The list of variables and the coding can be found in Table 1.

**Table 1.** List of the variables and coding

VARIABLES	Description
CHANGE_SUP_RAW	Dummy variable equals 1 if a firm has changed one or more suppliers of raw materials in 2022
CHANGE_SUP_DET	Dummy variable equals 1 if a firm has changed one or more suppliers of details/components in 2022
CHANGE_SUP_EQ	Dummy variable equals 1 if a firm has changed one or more suppliers of technological equipment in 2022
FT_reg_raw/det/eq1	The classification of firms by the type of their involvement into international supply chains. Group 1 include firms with regular export activity in 2019-2021 AND regular activity in importing raw materials/details and components/equipment in the same period.
FT_reg_raw/det/eq2	Group 2 include firms with no regular export activity in 2019-2021 AND regular activity in importing raw materials/ details and components/equipment in the same period.
FT_reg_raw/det/eq3	Group 3 include firms with regular export activity in 2019-2021 AND no regular activity in importing raw materials/ details and components/equipment in the same period.
FT_reg_raw/det/eq4	Group 4 include firms with no regular export activity in 2019-2021 AND no regular activity in importing raw materials/details and components/equipment in the same period.
SCM_digital_technology	Dummy variable equals 1 if a firm reported using SCM (supply chains management) digital technologies, zero otherwise.
New_prod_regular_3year	Dummy variable equals 1 if a firm introduced new products annually in 2019-2021, zero otherwise.
OLD_RUS_PART	Dummy variable equals 1 if a firm has strategic partnership established before 2020 with one or more Russian companies, zero otherwise.
OLD_FOR_PART	Dummy variable equals 1 if a firm has strategic partnership established before 2020 with one or more foreign companies, zero otherwise.
CEO_controlled	Dummy variable equals 1 if the CEO is a controlling owner or a member of the family controlling a firm, 0 – Hired CEO or coo-owner without controlled stakes.
log_suppliers_num	Logarithm of number of suppliers a firm has in 2022
SIZE1	Small firm with less than 100 employees
SIZE2	Medium-sized firm Small 100-249 employees
SIZE3	Large firm with 500 or more employees
logmain_prod_rev_share	Logarithm of the share of the main product in the annual revenue of a firm
Pavitt_taxonomy2	Group 1-supplier dominated, Group 2 – scale/information intensive, Group 3 – specialized suppliers, Group 4 – science-based

The results of probit-model estimations are reported in Table 2.

<sup>2</sup> According to Pianta M., Coveri, A., Reljic J. The Sectoral Innovation Database, 1994-2016. Methodological notes. MPRA paper No 106780, March 2021, p.11

**Table 2.** Determinants of changing supplier of raw materials/details&components/equipment in 2022

VARIABLES	(1)		(2)		(3)	
	CHANGE_SUP_RAW		CHANGE_SUP_DET		CHANGE_SUP_EQ	
	Coeff.	St.dev	Coeff.	St.dev	Coeff.	St.dev
FT_reg_raw1	1.151***	(0.112)	1.301***	(0.143)	1.282***	(0.210)
FT_reg_raw2	0.809***	(0.0963)	1.063***	(0.131)	1.054***	(0.196)
FT_reg_raw3	0.159	(0.146)	0.271**	(0.136)	-0.398	(0.299)
SCM_digital_technology	0.278**	(0.131)	0.283	(0.188)	0.264*	(0.141)
New_prod_regular_3year	0.193*	(0.108)	-0.132	(0.133)	-0.103	(0.120)
OLD_RUS_PART	-0.0158	(0.167)	-0.0555	(0.0790)	-0.343***	(0.121)
OLD_FOR_PART	-0.397***	(0.100)	-0.352***	(0.103)	-0.616***	(0.125)
CEO_controlled	-0.256***	(0.0697)	-0.156**	(0.0734)	-0.0819	(0.163)
log_suppliers_num	0.127***	(0.0395)	0.0515**	(0.0230)	0.164***	(0.0540)
Medium firm	0.00322	(0.0637)	0.160***	(0.0490)	0.178*	(0.0934)
Large firm	-0.190	(0.149)	0.122	(0.0942)	0.251***	(0.0658)
logmain_prod_rev_share	-0.373***	(0.135)	-0.691***	(0.155)	-0.534***	(0.155)
_IPavitt_2	0.288**	(0.112)	0.0614	(0.0892)	0.157	(0.102)
_IPavitt_3	0.110	(0.0723)	0.226***	(0.0730)	0.243**	(0.106)
_IPavitt_4	0.276**	(0.136)	0.0798	(0.0946)	0.150	(0.369)
Constant	0.159	(0.542)	1.384**	(0.668)	-0.125	(0.666)
Observations	1,732		1,732		1,394	

We have checked several other specifications that we have not reported here due to the lack of space. In particular, we included the pre-crisis (2021) share of Europe or China in the overall import of intermediate goods. The findings are ambiguous: for raw materials and details the higher share of Europe in imported supplies significantly increases the probability of changing supplier while the higher share of China in supplies significantly decrease the probability. But the dependence on import from one of those regions has no impact on the probability of changing equipment suppliers. Those results confirm a rather evident fact that re-configuration of supply networks was the result of Western sanctions. We have also checked for robustness of our results by including other variables in the regressions such as the date of the interview, job position of the respondent and others. Though the coefficients for those additional variables are significant in some specifications, our main results are robust.

In general, our results support our hypotheses. Involvement of firms into global value chains increases the probability of prompt supply chains' reconfiguration by substitution of suppliers. The coefficients for partnerships are significant for foreign partners in case of intermediate goods and decrease the probability of changes in supply chains. The local strategic partnerships have significant and negative effect only for change of equipment suppliers and probably are due to the firms that prefer to use the equipment from local producers. Quick replacement of suppliers in the supply network is significantly higher for more competitive firms that are active in terms of innovations and the use of digital technologies in SCM.

## 4. CONCLUSION

The sanctions of 2022 had actually a strong impact on Russian manufacturing firms. More than half of the respondents reported sanctions to have a strong negative or mostly negative consequences. Most of those negative effects are associated with the damage to supply chains: broken contracts, problems with financial transactions with partners and logistics. Our preliminary results show, first, that more globalized companies had to adjust their supply chains more often: the probability of changing suppliers of intermediate goods (raw materials, details and components) is highest for firms involved in two-way foreign trade and significant for those that depend on imported intermediates and/or equipment. Second, we see that technologically advanced and more competitive firms and firms in science-based industries were the most vulnerable to supply chains shocks. Third, our preliminary results show that the shock to supply chains can be successfully mitigated by creating more sophisticated networks that includes strategic partnership frameworks. Our results confirm the similarities of Russian and European firms in reaction to sanction damage to supply chains. Our contribution is in more nuanced investigation highlighting the positive role of domestic and foreign partnerships in providing robustness of supply chains, taking into account technological level of industries, firm product specialization, number of suppliers, perception of risks by different categories of respondents.

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